FOREIGN
BROADCAST
INFORMATION
SERVICE

JPRS Report

Science &
Technology

China

SCIENCE & TECHNOLOGY

CHINA

CONTENTS

SCIENCE & TECHNOLOGY POLICY

AEROSPACE

ADVANCED MATERIALS

SUPERCONDUCTIVITY

TELECOMMUNICATIONS R&D

/7310

Problems Developing Internal Combustion Engines in 1990's Analyzed

[Article by Hong Baoshun [3163 1405 7311] of Bureau of Construction and Agricultural Machinery of State Commission on Machine Building Industry and Hou Tianli [0186 1131 3810] of Shanghai Internal Combustion Engine Research Institute: "The Development of ICE Products in the PRC in the 1990's"]

[Text] Abstract

The status quo and existing problems of the ICE industry in PRC are discussed. The guiding philosophy, technical requirements and basic principles for drawing up the development outline and family spectrum of ICE products for the 1990's are described. Measures to be taken for the realization of the outline and family spectrum are proposed and a block diagram of the family spectrum is also provided.

A. Current Status of ICE Industry in PRC

1. Basic Situation

Since the Third Plenum of the Eleventh Congress of the Chinese Communist Party, as a result of policy changes, the ICE industry in China has made remarkable progress in the Sixth Five-Year Plan. The structure of the industry has changed. Compared to 1979, the number of plants producing internal combustion engines has decreased by 20.8 percent as of the end of 1986. Among these plants, 40.9 percent are plants manufacturing engines exclusively, 56 percent are plants producing engines and other products and 5.7 percent are plants making parts and accessories. The drastic reduction of the number of engine manufacturing plants signifies the concentration of ICE production in PRC. In 1986 the total production capacity was 70 million HP, representing a 13.5 percent increase as compared to 1979. The total value of engines and accessories produced in 1986 went up 13.5 percent as compared to 1979, 16.1 percent in complete engines and 9.5 in parts and accessories. Through research and development, import of advanced products, technical consultation and technology

1

trade, the technical standards of new Chinese ICE products have improved considerably. After these newly developed and imported models are manufactured and used, ICE products in PRC will be at the late 1970's and early 1980's level. Furthermore, there will be enough models to satisfy the market needs. However, these products are still being digested and absorbed for domestic production. It will take some time to go into production.

2. Major Existing Problems

(1) Low Profitability

The profit margin in the ICE industry in PRC in 1986 is around 11.8 percent. Only 1.6 percent of the products was exported. Compared to 1979, the profit margin dropped by 1.6 percent. One factor is that agricultural machinery is priced too low. However, another major reason is that the structure is unsound, production facilities are scattered and poor management. In a few high volume, better managed facilities, the profit was above 15 percent in 1986. However, it was below 10 percent in most plants. Some facilities even suffered losses.

(2) Few Batch Produced Models, Low Standards, Inability to Meet Demand

Since the implementation of the open policy, users have raised their demands for ICE products. More than one half of batch produced products are still at the 1950's and 1960's level. Most of them are bulky in structure, low in power, high in quality to power ratio, high in material consumption, and poor in profitability. Moreover, specifications such as start-up performance, smoke, exhaust and noise cannot meet user demands.

In terms of product models, most high volume products are single cylinder products. There are only a few high performance engines for heavy and light vehicles and multi-cylinder diesel engines for industrial machinery use.

(3) Poor Reliability and Short Lifetime

Although the quality of products has improved somewhat in recent years, however, it is still some distance away from the advanced level abroad. The useful lifetime and overhaul cycle for domestic products is approximately one half of that of foreign products. Product reliability management system has just been implemented.

(4) Low Technology, Outdated Equipment, High Scrap Rate, and Poor Material Utilization Rate

(5) Poor Quality Parts and Components, Low Professional Standards

This is a weak link which seriously impedes the quality of the engine. The parts and components industry in PRC does not have the capability to perform independent research and development. In addition, imported technology has not resulted in products yet. The industry needs a great deal of support and assistance to satisfy the demands for a new generation of products.

2

(6) Irrational Management System

The ICE industry has not been managed by a nationwide agency for a long period of time. There are many independent systems: 14 departments and 28 provinces, cities and autonomous regions in the PRC are producing ICEs. Some plants are large in scale and complete in capability and some are small in scale but complete in capability as well. There is a lot of repeated effort to import technology, duplicate construction and development. Parts and components developed for the same cylinder diameter (identical displacement) are not interchangeable. This causes the dilution of capital and technical manpower.

The main emphasis is usually placed on the engine and no effort is made to address parts, accessories and basic components, which leads to delay of new products into production. Very slow progress is made to manufacture products brought into China which delays the process to obsolete old products. If we are not determined to turn it around, it will be very difficult to change the basic picture of ICE products by the Eighth Five-Year Plan.

B. Guiding Philosophy and Basic Principles for Formulating the ICE Development Outline and Family Spectrum in the Eighth and Ninth Five-Year Plans

1. Historic Review

Since the First Five-Year Plan, China had prepared five family spectra for small and medium power diesel engines. Although these spectra did not become legal documents, their influence on product development, factory construction and technology reform is still considerable. Several series of products, such as the 95, 105, 135, 160, and 250 series, are still well received by the users because of good quality, low cost, ready availability of parts and familiarity of operation. Furthermore, under the guidance of the family spectra formulated, three generations of small and medium power diesel engines have been developed since 1950. As a result of technical progress, the products have been extended from agricultural applications to every sector of the economy. Steel consumption has dropped from 34 kg/kw to less than 5 kg/kw. Iron consumption also decreased by 3/4 and fuel consumption was reduced by 20 percent. Obviously, due to the influence of the isolation policy and the constraint of the management system, the family spectra formulated before were not fully successful in modernizing diesel engine products. However, in view of past experience we are confident that it is necessary to draw up a new development outline and family spectrum. Furthermore, as the reform moves along, the division by department or local authority will disappear. It will be very favorable to implement the plan which will result in huge economic and social benefits.

2. Nature of the Outline and Family Spectrum

In a reform the outline and family spectrum should provide the guidance, policy and decree for the program. We not only must understand the status at all levels where plans are formulated and understand the trend of technical development to provide guidence to the development of strategy and new products,

3

but also must provide as much market and technical information as possible. In terms of policy, the new family spectrum must be coherent with the fuel policy, technology policy (key technology development areas at the time), and economic policy (such as open door policy and cooperation policy). The outline and family spectrum should be in the form of a decree which also incorporate other relevant national standards and regulations. In addition, low-quality products that consume more materials and energy must be limited and made obsolete in time. Excessive import and duplicated development of new products will be curbed.

3. Based on the potential level of achievement in economic development in the 1990's, there may not be enough capital to build more large-scale plants. Therefore, existing large plants must be modified. More importantly, we must rely on a large number of medium and small factories to realize the technology reform. They should be encouraged to work with research institutions to continuously improve management and technical levels in order to become partners or competitors of their larger counterparts.

4. Basic Principles To Follow in Drawing up the Outline and Family Spectrum

(1) The basis is to provide a variety of ICE products at different levels to satisfy the needs in the assembly of major equipment and to open up international market. In the Eighth and Ninth Five-Year Plan periods, the technology level of ICE products will be significantly raised to narrow the gap with advanced world levels.

(2) The number of basic series should be rationally controlled. The processing capability and technological potential of the factories should be fully utilized to produce a variety of products. Seriation of products would expand the applicability range of the basic series. Accessories and parts, especially parts that wear out easily, should be highly interchangeable between basic and modified models to raise the degree of seriation, generalization and standardization. This will facilitate the mass production of complete engines, accessories and parts.

(3) Priority should be given to high-quality name brand products, high volume products manufactured by key facilities, and advanced products that have been imported or developed in recent years.

(4) In technology, civilian and military must work together and allow the military to lead the civilian. Industry and agriculture must be combined and industry used to push agriculture forward. Export and domestic market must be combined to use export to lead domestic consumption to make the family spectrum satisfy the needs at all levels.

(5) Some overlap should be allowed to encourage competition and joint effort to push technology forward. However, we must prevent too much overlap especially at the lower level. The basic concept is that widely used, high volume products will be listed by series number (by displacement or cylinder diameter) in the new family spectrum. No specific model numbers will be given. Individual business entities or consortia will be invited to bid. The

4

selected series of products will be named by the State Commission on Machine Building Industry as the national series in the Eighth or Ninth Five-Year Plan. They will be given various economic incentives. In addition, no more than three product series will be selected in the same class.

Products eligible to participate in the bidding must meet the following conditions.

a) The series must either belong to products scheduled to be developed in the Eighth Five-Year Plan, or can already be batched produced in the Seventh Five-Year Plan, or its basic prototype has been certified by the State Commission on Machine Building Industry before 1988 and capital and production preparation plans are in place so that batch production can be ensured before 1993. As for imported products, it is required that domestically made prototypes or versions (more than 80 percent made in China by value) meet the above schedule.

b) Series to be developed in the Ninth Five-Year Plan must either already be batch produced in the Eighth Five-Year Plan, or basic prototypes certified by the State Commission on Machine Building Industry before 1992 and capital and production plans secured to ensure batch production prior to 1998. The same requirements exist for imported products.

c) The product submitted for bidding must meet all technical specifications of the family spectrum.

d) There must be some production capacity for the product submitted for bidding. In principle, it should have a capacity to meet more than one-fifth of the annual demand for this class of products.

e) The bidding institution must have strong capability in design management and technology development to ensure interchangeability and high degree of standardization.

C. Certain Technical Requirements of the Development Outline and Family Spectrum

1. Development Trend of Conventional Internal Combustion Engine Technology

(1) The range of applications was expanded by conservation of raw materials and capital for plant construction. This policy ought to be continued to some extent in the future, not only to satisfy the needs of economic development but also to provide the necessary means for the industry to increase its capability of capital accumulation and self-reform, to accelerate product renewal and to improve productivity. However, because the operating environments and maintenance conditions of ICEs are limited in China, also in order to conserve the precious petroleum resources and to improve engine reliability, the primary means to produce a more powerful engine is to use a turbocharger to increase the effective mean pressure and power of the engine. The following is a table listing the mean effective pressure p. of engines produced in the Eighth and Ninth Five-Year Plan periods.

5

Basic diameter (mm)	Turbocharge				Pressurized			
	pe (MPa)		% products in same series		pe (MPa)		% products in same series	
	8th FYP	9th FYP	8th FYP	9th FYP	8th FYP	9th FYP	8th FYP	9th FYP
< 98	> 0.9	> 0.9	sample	20	—	—	—	—
100 ~ 115	"	> 1.0	20	60	> 1.1	> 1.2	20	20
120 ~ 140	"	"	"	"	"	"	5	30
150 ~ 170	"	"	40	80	> 1.2	> 1.4	10	20
180 ~ 240	"	"	80	60	"	"	20	40
250 ~ 350			70	50	"	> 1.6	30	50
400 ~ 600					> 1.4	> 1.8	100	100

(2) Although the prospect of exploration of petroleum resources in China is bright, however, the amount available per capita is very low and resources are limited. Therefore, every drop of oil must be treasured and conserved. One of the major technical development directions is still to continue improving the fuel economy of ICE. In the area of gasoline engines, we should gradually raise the compression ratio and increase the octane number of the gasoline. The compression ratio of any gasoline engine more than 100 mL in displacement should be above 8 in the Eighth Five-Year Plan. Furthermore, we should study layered combustion to further increase the combustion ratio and to burn different fuels. In the Ninth Five-Year Plan, we must work hard to bring it above 9 and try to commercialize gasoline engines with multiple air intakes at a compression ratio over 10. Moreover, the ratio of heavy duty vehicles equipped with diesel engines to gasoline engines will be gradually increased to 3 : 7 in the Eighth Five-Year Plan and 1 : 1 in the Ninth Five-Year Plan. Preparation will be made not to produce any gasoline engine more than 5 L in displacement.

Direct fuel injection combustion chamber will be used in more diesel engines. In the Eighth and Ninth Five-Year Plan periods, it will be used in engines with cylinder diameter greater than 100mm. Industrial diesel engines with cylinder diameter less than 98mm also should widely use direct fuel injection. Small batches of direct fuel injection diesel engines will be manufactured for agricultural use in the Eighth Five-Year Plan. It will be widely promoted in the Ninth Five-Year Plan if after sales service and user standards are improved.

Studies should be done to explore the use of low-quality fuel in medium and large diesel engines in order to expand fuel supply and power operating cost.

(3) The most urgent problem is to raise the reliability and useful lifetime of ICE products. In addition to improving product quality in the Eighth Five-Year Plan, ICE manufacturers should perfect the reliability of their products, establish scientific management systems, and set up good relationship with their users. Before the national standard for product reliability is issued, the requirements listed in the family spectrum should be used as a reference for the users. In order to urge the industry to track the usage of the products, mean time between failure and mileage driven are defined as actual statistic numbers in use and sampling should be done at 5 percent but no less than 5 units. When the annual sales volume is less than 5 units, 100 percent sampling should be done. When the annual sales volume is over 10,000 units, 500 units will be sampled for statistics.

We must work hard to raise the product standard and to improve after sales service. High-quality lubricants should be used to lengthen the maintenance period to reduce operating cost, conserve lubricant use, and save other maintenance materials.

(4) People are more aware of the pollution (exhaust and noise) generated by ICEs. Environmental protection requirements should be included in the family spectrum. The environmental indicators of any ICE product that is either driven around town or used for a specific application must satisfy the standards set by the city or area (such as ICE for mining use).

(5) It should be particularly pointed out that an important technical development direction is to continuously lower the cost of ICE for agricultural use. In addition to lower the quality-to-power ratio, perfecting management, and expanding batch production, va ue engineering should be designed into the products. Based on different applications, we should simplify the structure and adopt new materials and technology. In the area of quality improvement and cost reduction, we should explore all potential possibilities. The ICE industry in China has been successfully using nodular cast iron for over 30 years. Furthermore, China is abundant in rare earth resources. The research in this area should be intensified to further expand its range of applications. Other areas, such as the use of reinforced plastic and ceramics in ICE, should be promoted to serve as a reserve in the development of ICE.

(6) As for electronic control of ICE, China has begun research in this area. However, accomplishments in research should be applied in production. In the Eighth Five-Year Plan, electronic control should be realized in failure diagnosis and automatic safety protection of high-power diesel engines in military, ship and railroad applications. Some electronically controlled ICE products should be used for performance optimization and exhaust control in heavy duty vehicles and passenger cars in the Ninth Five-Year Period.

2. Research and Development of Other Engine Models

(1) Multi-Stack Rotary Engine

The research began in China in the early 1960's. Encouraging results have been obtained. A number of such engines are being tested in automobiles and hovercraft over extended periods of time. Compared to conventional diesel engines, they are compact (approximately 1/2 in volume), light (approximately 70 percent in weight), and simple in structure. If mass produced, the cost will be low. However, their fuel consumption is high (close to the gasoline engine) and its wear resistance is relatively low. It seems that at least it may be suitable for use in gardening machinery, light duty generators and boats where the rate of utilization is not very high. As the technology matures further in the future, its varieties and applications will be expanded. In the Eighth Five-Year Plan, it should still be included in the research and development and new product development plan. Moreover, some prototype engines should be marketed. Arrangements for the Ninth Five-Year Plan will be made based on the outcome in the Eighth Five-Year Plan.

(2) Hot Gas Engine

The special feature of the hot gas engine is that it can use a variety of fuels, including solar energy. There is no pollution and the thermal efficiency is high. It is a promising engine from the angle that local fuel can be used to replace petroleum. However, it is relatively high in volume and weight and its cost is also high. Since 1978, research has begun at the

Shanghai Institute of Diesel Engine for Ship Use. This work should continue. We should first develop a hot gas engine that burns local fuel or solar energy for use in remote areas for agricultural use or for power generation. The range of applications will be enlarged after the technology matures. It should be commercialized in the Ninth Five-Year Plan.

(3) Other Substitute Fuel Engine

For example, the operating cost of natural gas engine is low. Natural gas is widely available in PRC. Therefore, it should be promoted in areas with the resources. Because the demand is not very high and there are numerous models, we should modify conventional gasoline and diesel engines to meet this demand.

4. Necessary Measures

In order to realize the ICE product development outline and family spectrum described earlier, a series of measures should be taken:

1. Policy should be drafted to provide economic incentives for products selected. For example, the national series will be included in the long range and annual plans for product development and technology reform and enjoy a 3-year tax free status for encouragement. If an obsolete product is still manufactured and marketed, an extra waste tax should be imposed and a production permit will not be issued.

2. The new family spectrum will be used as a basis to clean up all imported products. Laws and regulation will be drawn up to limit blind and duplicated efforts to bring in foreign products. We should speed up the pace to digest the products and technology that we already imported and quickly convert them to domestic production. Future product import and capital investment should be focused on the quality improvement and batch production of parts and accessories. The bidding method described above will be used to select manufacturers for low level products. All applications for technology import will be strictly reviewed.

3. We will soon begin drawing up the family spectra for parts and accessories, such as turbochargers, carburetors, spark plugs, glow plugs, fuel pumps, fuel injectors, starter motors, generators, air filters, fuel filters and oil filters, and development plan for easily worn components, including cylinder linings, pistons, piston rings, axles, air valves, heavy duty springs, gear belts, cylinder jackets, water seals, and oil seals, to satisfy the needs of the complete spectrum of engines. It also will improve the level of parts and accessories produced.

4. A fund dedicated to the development of ICE equipment should be established from the capital set aside for basic construction or technology reform in the form of an interest free loan to independently provide high technology modern equipment for the industry. The loan will be repaid by organizations that benefit from the program. The fund may be managed by an entity formed by people from the ICE industry, technical research institutions and machine tool industry.

Block Diagram of ICE Series in the PRC

ICE Family Spectrum

High-speed diesel series — DH-1 series, DH-2 series, DH-3 series

medium-speed diesel series — DM-1 series, DM-2 series, DM-3 series

low-speed diesel series — DL-1 series, DL-2 series, DL-3 series

two-cycle gasoline engine series — GE-1 series, GE-2 series, GE-3 series

Four-cycle gasoline engine series — G-1 series, G-2 series, G-3 series*
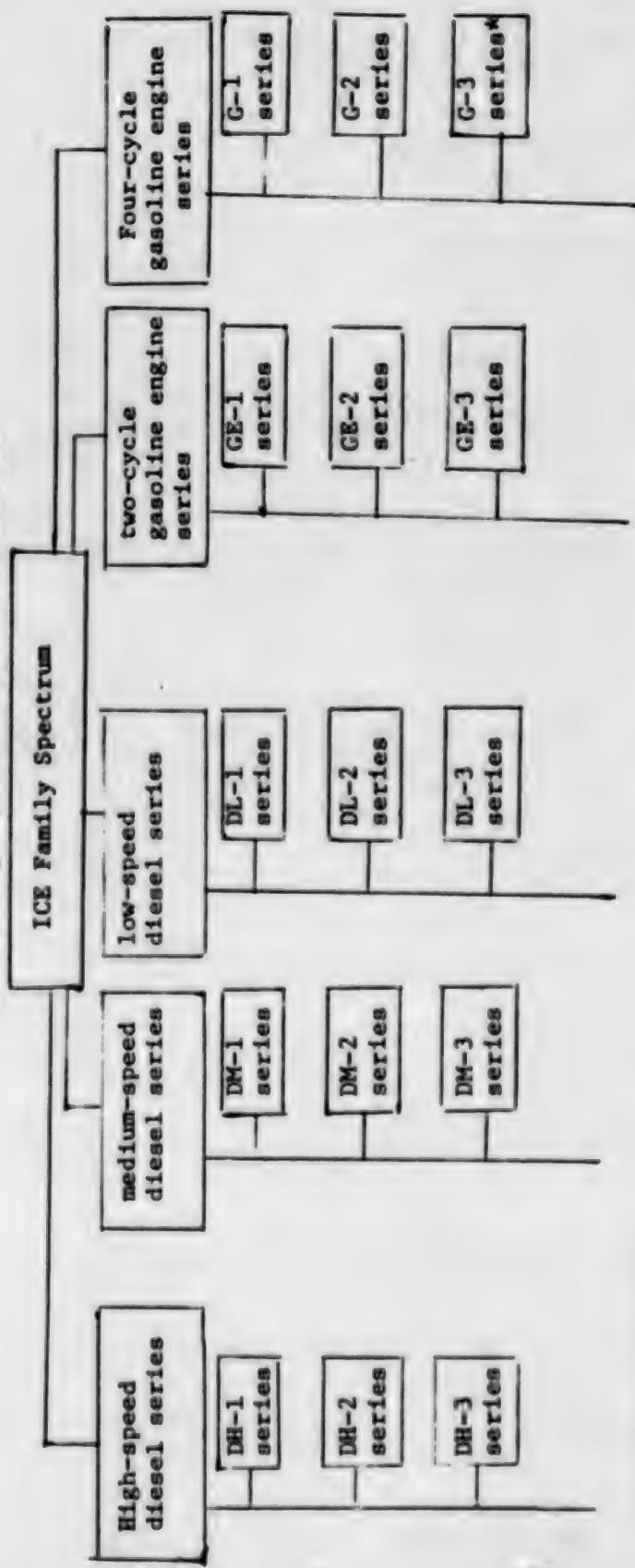
* Up to three structurally different sub-series are allowed in each class.

10

5. Pertinent standards should be established or modified.

6. An anti-trust law will be drawn up and a system for technology transfer with compensation will be implemented. Any industry that holds a monopoly on technology will be isolated and prohibited from participating in technology exchange. Technology exchange is encouraged and technology blockade is opposed. This will promote technology advancement and allow advanced technology and products enter the market.

7. In order to raise the level of ICE, it is necessary to gain the support and cooperation of all relevant departments. In order to provide high quality lubricants and fuels to meet the needs of the new spectrum, petroleum supplying departments must draw up a series of unified standards. Lubricants at the CC and CD level should be supplied for diesel engines, SD and SE lubricants for gasoline engines, and TSC-2 and TSC-3 lubricants for two cycle gasoline engines. Number 80 and 85 gasoline should be supplied. The supply of raw materials also requires the cooperation from various departments in metallurgy, light manufacturing and chemical engineering.

8. The family spectrum should remain relatively stable. It will be modified periodically by the State Commission on Machine-Building Industry.

12553/08309

Financial Grants by Natural Science Foundation for Genetics Research

[Article by Wang Qinnan [3769 2953 0589], National Natural Science Foundation Committee: "Financial Assistance For Genetics Provided by the National Natural Science Foundation in 1987"]

[Text] The National Natural Science Foundation has completed its 1987 evaluation work, the results of which have been announced as shown in the table below.

During 1987, the National Natural Science Foundation accepted for consideration a total of 3,341 applications, of which 904, or 27 percent, were approved for financial assistance following evaluation. The amount of funds approved amounted to 13 percent of the total amounted requested.

Two hundred forty-two applications were accepted for consideration in the field of genetics, of which 66, or 27 percent, were approved for financial assistance. In addition, five requests that were consistent with "new concepts and new ideas" in high technology were made topics for exploration using new concepts and new ideas in high technology. Overall, the quality and level of topics for which funding was requested in 1987 was higher, and they were more competitive. Topics deserving of financial assistance numbered far more than half. However, because of limitations on the amount of funds available from the foundation, even though financial assistance was given to 7 percent more applicants than had been originally planned, bringing the total to 27 percent, financial assistance was not available for more than half the number of topics presented. Even so, an overwhelming majority of those receiving financial assistance got too little.

Most of the financial assistance went to basic research of important theoretical significance, and second to applied basic research projects showing promise for application. In general, no financial assistance was given for duplicatory work, for topics and high technology slated to be tackled during the Seventh 5-Year Plan, or research on other tasks.

It is apparent from the nature of projects for which financial assistance has been provided in recent years that, within the two categories of topics mentioned above for which financial assistance has been granted, next year the emphasis will be on providing financial assistance to research projects that inventory national resources, and research in the field of genetics on resources that are valuable, scarce, and special with a view toward making a contribution to running the country, and to protecting and making rational use of natural resources. If possible, uniquely Chinese research topics of major importance having an important effect on the national economy and the people's livelihood will be organized, such as the genetic background values for each of China's national minorities, systematic study of various major farm crops that had their origins within China, and the environment and genetic toxicology for the purpose of accumulating data, and providing a theoretical basis and technical measures for understanding in a rational way China's population problem and food problem, people's health, and protection of the natural environment.

Number	Title of Project	Name	Position	Unit Name	Beginning and Ending Month and Year
6008	Screening and Genetic Research on Corn Type C Cytoplasm Antiviral Mutants	Dai Jingrui	Associate Professor	Beijing Agricultural University	Jan 1988 - Dec 1990
6012	Research on the Effects of Allocytoplasm on the Economic Properties of Common Wheat	Xu Haiyu	Professor	Wuhan University	Jan 1988 - Dec 1992
6013	Research on Phytochemical Mutagen Genetic Effects and Application	Xu Yuekui	Professor	Jilin Agricultural University	Jan 1988 - Dec 1992
6018	Genetic Research on New Male Sterile Wheat Plans	Zhang Cailun	Associate Researcher	Genetics Institute, Chinese Academy of Science	Jan 1988 - Dec 1990
6033	Research on Light and Temperature Conditions For Control of Male Sterility in Type K Wheat	Wang Peitian	Associate Researcher	Genetics Institute, Chinese Academy of Science	Jan 1988 - Dec 1990
6026	Use of Experimental Red Flour Beetle [Tribolium castaneum] to Study Animal Genetic Theories and Breeding Methods	Zhang Lao	Lecturer	Beijing Agricultural University	Jan 1988 - Jan 1990
6029	Study of Interspecific Crossbreeding of Silkworm and Their Genetic Transformation	Chen Yuanlin	Associate Professor	Xiamen University	Jan 1988 - Dec 1990
6033	Study of the Hybrid Sterile Mechanism in the Crossbreeding of Horses and Donkeys	Pan Cengrum	Associate Researcher	Lanzhou Livestock Institute, Chinese Academy of Agricultural Science	Jan 1988 - Dec 1990
6114	Quantitative Biological Research on Gene Function	Liu Ciquan	Associate Researcher	Kunming Zoology Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990

6118	Research on High Temperature Bacteria Enzyme Gene Regulation and Their Heat-Resisting Mechanism	Zhang Zujie	Professor	Fudan University	Jan 1988 - Dec 1990
6120	The Role of E. coli Recombinant Gene in DNA Replication	Sheng Zujie	Professor	Fudan University	Jan 1988 - Dec 1990
6123	Regulation of Transcription and Translation of the Yeast Proline Synthesis Gene	Hu Zhaoqing	Associate Researcher	Shanghai Cell Biology Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6173	Bacillus subtilis Molecular Clone Receptor Transformation and the Structure of Multifunctional Carriers	Guo Xinghua	Associate Researcher	Microbiology Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6182	Structure of Saccharomyces Shuttle Vector and Cloning of Enzymes	Cai Jinbo	Researcher	Microbiology Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6186	Study of Yeast Deep Integrated Vectors	Liu Peipeng	Lecturer	Jinan University	Apr 1988 - Apr 1991
6217	Study of Liposome Encapsulation Exogenous DNA Imported Microbes and Plant Cells	Hu Xiaowu	Associate Researcher	Shanghai Plant Physiology Institute, Chinese Academy of Sciences	Jan 1988 - Feb 1990
6220	Study of the Exploitation and Genetics of Natural Yeast Enzymes	Wang Tianru	Associate Professor	Nankai University	Jan 1988 - Dec 1991
6233	Study of Streptomycete Promoters	Deng Keming	Associate Researcher	Microbiology Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6039	Study of the Blood Relationship Between Taiwan and Mainland Groups of People	Du Rufu	Researcher	Genetics Institute, Chinese Academy of Sciences	Jan 1987 - Dec 1990

No.	Title	Name	Position	Institution	Date
6040	Study of HLA Super Type Gene Shift Among Northwest China Groups	Sun Yiping	Associate Researcher	Clinical Medicine Institute, Sino-Japanese Friendship Hospital	Sep 1987 - Dec 1989
6044	Study of Human Chromosome Fragile Regions	Wu Lifu	Associate Professor	Guiyang Medical Academy	Jan 1988 - Dec 1991
6045	Apolipoprotein A1 and C3 Gene DNA Polymorphism, and Hyperlipemia and Arteriosclerosis	Zhang Guiyan	Professor	Harbin Medical University	Jan 1988 - Dec 1990
6046	Genetic Pharmacology: Individual Differences and the Mechanism Whereby Medicine is Metabolized in Chinese	Jiang Wenb	Professor	Shanghai Medical University	Jan 1988 - Dec 1990
6050	Study of the Oral Cavity Physiology and Illnesses of Stone Age Human Skulls Excavated at Tudun Si, Jiangsu Province	Long Baoyan	Lecturer	Shanghai Railroad Medical Academy	Jan 1988 - Dec 1989
6120	Study of Cranial Capacity Measurements and Multiple Statistical Analysis of Them	Ding Shihai	Professor	Lingi Clinical Medical Professional School	Jan 1988 - Dec 1990
9052	Study of the Molecular Evolution of Several Different Primate	Liu Zuodong	Professor	Peita University	Jan 1988 - Dec 1990
6111	Phylogeny of DNA Clock [sic] and Chinese Alligators	Wu Xiaqun	Associate Researcher	Developmental Biology Institute, Chinese Academy of Sciences	Jan 1988 - Jun 1990
6112	Molecular Cloning of Restrictive Satellite DNA and Its Address on Chromosomes	Wu Zheng'un	Associate Researcher	Developmental Biology Institute, Chinese Academy of Sciences	Jan 1988 - Jun 1990
6165	Molecular Cloning of Cow Lactation Hormone and Analysis of cDNA Base Sequences	Song Shihe	Physician-in-charge	Tianjin Academy of Medicine	Jan 1988 - Dec 1990

No.	Title	Name	Position	Institute	Dates
6036	Cytological Research on Wild Rape from Xinjiang Province	Chen Qingsheng	Associate Researcher	Cash Crop Institute, Xinjiang Academy of Agricultural Sciences	Jan 1987 – Jan 1991
*6039	Study of the Molecular Biology of the Male Sterile Mechanism in Corn Cytoplasm	Liu Jilin	Professor	Central China Agricultural University	Jan 1988 – Dec 1990
6040	Study and Use of the Dwarf Development of Tropical Trees	Liu Sengyuan	Researcher	Rubber Institute, South China Tropical Crops Institute	Jan 1987 – Sep 1991
6087	Genetics of the Development of Photosensitive Sterile Rice	Wang Xiaoping	Professor	Wuhan University	Jan 1988 – Dec 1991
6093	Study of Techniques For Transferring Chromosome Segments Being Irradiated Pollen	Wang Heumong	Associate Professor	Xiamen University	Jan 1988 – Dec 1990
*6101	Study of the Molecular Basis For Phenotype Variation – Plant Promoters and Movable Components	Qi Dafeng	Associate Researcher	Shanghai Biochemistry Institute, Chinese Academy of Science	Jan 1988 – Dec 1990
6102	Study of the Structure and Function of Chloroplast Genes in Higher Plants	Wu Naihu	Associate Researcher	Developmental Biology Institute, Chinese Academy of Science	Jan 1988 – Dec 1990
*6103	Analysis of the Structure of the Physical Atlas of Paddy Rice Chloroplast DNA, Gene Location, and Sequencing	Shen Guifang	Associate Professor	Hangzhou University	Jan 1988 – Dec 1991
6104	Study of Restorer Agents and of the Fertility Restoration Mechanism in Male Sterile Paddy Rice	Liu Zusheng	Associate Researcher	Genetics Institute, Chinese Academy of Sciences	Jan 1988 – Dec 1990

6109	The Correlation Between Post Calorie Cytochrome Oxidase Specific Sub-base and Male Sterility in Sorghum	Zhang Kunghua	Associate Researcher	Genetics Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6075	Study of the Structure and Function of Nucleolar Chromosome in the Mammary Gland Lymphocytes of Adenocarcinoma Patient	Liu Jieping	Associate Professor	Beijing Medical University	Jan 1988 - Dec 1990
6076	Study of the Molecular Cytogenetics of Acrocentric Chromosomes	Cheng Zaiyu	Associate Researcher	Preclinical Medical Institute, Chinese Academy of Medical Science	Jan 1988 - Dec 1990
6077	Genetic Study of Vertical Transmission Cells of Type 3 Hepatitis Surface Antigen	Dong Xiaoyang	Professor	Qingdao Academy of Medicine	Jan 1988 - Jun 1989
6093	Study of Genetic Toxicity Effects of Cumulative Radiation in Contaminated Barrier Facilities	Du Zhaoyang	Professor	Suzhou Medical Academy	Jan 1988 - Jun 1990
6124	Molecular Genetic Study of Leukemia and Lymphoma and Its Application	Cong Yongliang	Lecturer	Tongji Medical University	Jan 1988 - Dec 1990
6129	Study of Pathogenic Mutations in Human Globin Genes	Wang Zhwen	Associate Researcher	Preclinical Medical Institute, Chinese Academy of Medical Science	Jan 1988 - Dec 1990
6131	Study of Colon-Rectal Cancer and Familial Polypoid Colon Carcinoma Genes	Li Shunda	Associate Researcher	Tumor Research Institute, Chinese Academy of Medical Science	Jan 1988 - Dec 1990
6133	Research on the Mapping of Active Genes in the Human Genome	Li Guiyuan	Associate Researcher	Hunan Medical Academy	Jan 1988 - Dec 199

No.	Title	Name	Position	Institution	Date
6139	Study of Abnormal Hemoglobin in Yunnan Province's Minority Nationalities	Lu Yenan	Associate Professor	Kunming Medical Academy	Jan 1988 - Dec 1990
6140	Research on Gene Introduction to Compensate for Defective Cells in the Repair Function of Genetic DNA	Chen Qu'e	Associate Researcher	Institute of Biophysics, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6141	Study of Clonal cDNA Probes Against Human Sterol 21 Hydroxylase Gene Deficiency and Polymorphism	Wang Defen	Professor	Shanghai No 2 Medical University	Jan 1988 - Dec 1990
6142	Study of Various Methods for Detecting Hepatomolecular Degenerative Deoxyenzyme and Their Computer Analysis	Chen Xiuzhen	Associate Professor	Shanghai Medical University	Mar 1988 - Mar 1990
6143	Study Using Field Mice Cheek Pouch Transplants in Setting Up Human Genetic Disease Cell Bank	Zhao Yongquan	Associate Researcher	Tianjin Medical Academy	Jan 1988 - Dec 1990
6146	Research on Pathogenic Genes Causing Childhood Rheumatoid Arthritis	An Jiabin	Assistant Researcher	Beijing Pediatrics Institute	Jan 1987 - Dec 1989
6322	Research on the Structure of Blood Platelet Derived Growth Factor A Chain Gene and Cell Engineering	Ye Xiuzhen	Associate Researcher	Shanghai Cell Biology Institute, Chinese Academy of Science	Jan 1988 - Dec 1990
6325	Study of Human and Human Brain Glioblastoma Monoclonal Antibodies	Zhao Wenbao	Researcher	Beijing Municipal Neurosurgery Institute	Jan 1988 - Dec 1989
6149	Study of Cyanobacteria as Gene Clone Expression System	Gu Huixin	Lecturer	Guangxi Medical Academy	Jan 1988 - Jan 1991
6151	Research on the Development of Halophilia Genetically Engineered Receptor System	Lou Dilin	Associate Professor	Xiamen University	Jan 1988 - Dec 1990

ID	Project Title	Name	Position	Institution	Date
6162	Study of the Application of "..." (3029 3692 2704) Technique to Obtain Secondary Plant Metabolism Products	Geng Liaowei	Lecturer	Southwest Teachers University	Jan 1988 - Dec 1990
6392	Three Body Engineering of Beets (Selective Breeding of Sterile Three Body Series and Single Body Added Series)	Guo Dadong	Associate Professor	Heilongjiang University	Jan 1988 - Dec 1990
6041	Study of Sea Urchin, Scallop, and Oyster Caryotypes	Teng Hanxian	Lecturer	Shandong Marine Academy	Jan 1988 - Dec 1990
6044	Study of Chinese Ox Chromosome Polymorphism and Possibilities for Its Application in the Cattle Raising Industry	Tu Ruiliang	Associate Researcher	Livestock Research Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6070	Study of Chinese Rat (Rattus) Caryotypes and Their Genome Evolution	Chen Yifeng	Professor	Nanjing Teachers University	Jan 1988 - Dec 1991
6073	Study of Genetic Damage From Methyl Mercury in the Environment and Its Prevention and Treatment	Li Zhichu	Lecturer	Norman Bethune Medical University	Jan 1988 - Dec 1990
6090	Study of Hog Chimera	Shen Senbing	Intern Researcher	Developmental Biology Institute, Chinese Academy of Science	Jan 1988 - Dec 1990
6207	Root Differentiation of Stripe Gentian Tissue Culture and Production of Medicinal Component	Wang Zhiguo	Assistant Researcher	Beijing Academy of Medical Science	Jan 1988 - Dec 1990
6235	Chromosomes and Isoenzymes in Chinese Chiroptera	Zhang Weidao	Lecturer	Anhui Teachers University	Jan 1988 - Jan 1991

Transferred 863 Project

6011	Genetic Study of the Establishment of a Wheat Root Fungus Monoclonal Antigen Differentiation Host System	Wu Yousan	Professor	Shenyang Agricultural University	Jan 1987 - Dec 1990
6204	Screening of Paddy Rice Hyperproline Cell Mutants and Their Correlation To Salt Tolerance	Chen Shaolin	Associate Researcher	Genetics Institute, Chinese Academy of Sciences	Jan 1988 - Dec 1990
6202	Selection and Study of Asparcet [Onobrychis sativa] Variant Lines That Resist Salinity and Heal Wounded Tissue	Gu Zhuping	Associate Professor	Lanzhou University	Jan 1988 - Dec 1990
6211	Sheep and Goat Embryo Fusion and Goat Ovokaryon Transplants	Wang Jianchuan	Professor	Northwest Agriculture University	Jan 1988 - Jan 1993
6226	Research and Development of Liver Cancer Clonal Antibody - Astatine-211 "Missile" Medicine	Zhou Maolun	Researcher	Sichuan University	Jan 1988 - Dec 1990

* denotes key project

Big Economic Impact Reported in Switchover From Military to Civilian Production

40080012b Beijing BEIJING KEJI BAO in Chinese 30 Jul 88 p 1

[Article by correspondent Hao Meifang [6787 2734 5364] and Fudan University intern Huang Donghong [7806 2639 4767]: "Technology Transfer from Military to Civilian Found Successful"]

[Text] Under the new reforms, The Chinese Space Technology Institute, which is located in the Haiding experimental zone for new technology development, begins to impact on society and to provide services to all sectors of the economy. It is respected by the electronics industry for its strong technology base and transfer of advanced technology from military to civilian.

The Chinese Space Technology Institute is the organization which developed satellites in China. To date, 22 satellites have been successfully launched. Since the Third Plenum of the Eleventh Congress of the Chinese Communist Party, the technical staff has been devoted to the reform in order to contribute to the economic construction. The government spent a great deal of money to develop certain projects. In addition to military applications, they are also useful in many sectors of the economy. We should release them to serve society. In recent years, the Institute has devoted approximately one-third of its technical resources to the development of civilian products despite a heavy responsibility to develop and produce satellites. Numerous advanced technologies used on satellites have been applied to various production areas. For example, the 508 Institute converted the timer mechanism used on satellites to household appliances. In a very short period of time, a washing machine timer was developed in contrast to the prediction by the Japanese that it would take China a long time to do so. Several dozens of local businesses are involved in the production of these timers. A number of businesses on the brink of bankruptcy were saved. The production capacity reaches 2 million timers per year. It is one of four major washing machine timer producing groups.

As another example, the monitoring and control system used in the production of the Model MSC microcomputers and the STD 5200 series industrial controllers developed by the 502 Institute have been used in many areas in China for automatic control. After the Huabei Pharmaceutical Plant used a microcomputer-based control system in the fermentation process for antibiotics, the products reached the same quality level as those produced by similar equipment abroad. After using the MSC microcomputer-based

21

production monitoring and control systems, over a dozen oil fields such as Dagang and Shengli and the Beijing heat pipe grid can accurately monitor operations several dozens of kilometers away. Production problems can be handled in time to conserve energy and improve safety.

It is particularly worthwhile to point out that Chinese Space Technology Institute is especially interested in promoting advanced technology for civilian industry in Beijing. Their low cost, high-quality service is well received by all kinds of businesses in Beijing. For example, they gave the film track control system to the Beijing Culture and Education Products Plant and the Institute of Photography of the Chinese Academy of Sciences to solve an old waste problem in production. This technology alone brings the profit up by approximately 10 percent. It took some businesses only 2 to 3 weeks to recover all the investment for this device. If it is imported, such a device would cost more than $7,300.

In addition, the Chinese Space Technology Institute transferred the high technology heat pipe exchanger, which was developed for satellite temperature control, to several local businesses for production. It will be widely used in various heat exchangers in areas such as waste heat recovery in drying plants, energy conservation in chemical plant equipment, and residual furnace heat utilization to improve efficiency by 15-30 percent. The Model LRK-2 series heat pipe boiler, which was jointly developed with the county of Pinggu, has been included in the "Spark Plan" for general promotion.

Based on our understanding, the China Space Technology Institute will establish an entity to combine science, engineering and business based on aerospace technology. It is planned to be an important growth area in the Haiding experimental zone for new technology development.

12553

Issues Confronting Reform of S&T Management Discussed

40080194 Tianjin KEXUEXUE YU KEXUE JISHU GUANLI [SCIENCE OF SCIENCE AND MANAGEMENT OF S&T in Chinese Aug 88 pp 9-12

[Text] In China, generally there are three traditional kinds of methods used by specialized research institutes in the selection of research subjects: 1) Subjects can be taken from the national long-term research program or distilled from major projects involving many research subjects; 2) Problems for research can be extracted from the most important areas of production, and 3) Subjects may be selected by the scientists themselves, based on international trends in science development.

The important problems are in the following areas: 1) The national research subject program often begins well but finishes poorly. Strict inspection of conditions of execution of the program is lacking. Some organizations merely exploit inspections as a method of applying for funding. Abstraction of subjects from missions involving many topics often is lacking in organization and cooperation. New contradictions arise in the process of completing the project or stages of the project, creating difficulties in implementing cooperation; 2) Concerning the second method, sources of subjects are often of a spontaneous or random nature. We have not begun from a far-sighted point of view, to set up organic contracts between research and production, nor have we followed product improvement in developing projects designed to catch up technologically. Proportionally, the number of research problems selected by this method is too small; and 3) The third method does not function easily in the current trend toward emphasis on money. Relevant technical personnel are unwilling to insist on a subject if it doesn't provide material benefit. It seems that without special measures, after a period of time, motive force become inadequate.

In the U.S., many universities and research institutes use the second method in selecting research topics. For example, M.I.T. established an industry liaison department to strengthen contacts with industry. Many American universities have established long-term cooperative relationships between industry and their own specialized research departments. Some large companies, although they have their own research

23

departments, can, if they cooperate with outside organizations, save time and money. These outside organizations generally will not have all-inclusive systems. Because of this, on a national level there is little overlap of research subjects. Work of a basic or long-term character relies on application for scientific funding as the primary method. Encouragement of initiative on the part of S&T personnel must come through salary increases rather than through monthly or yearly bonuses.

Based on the present conditions in China I suggest: 1) Energetically promote the second method of subject selection. Gradually increase the proportion of subjects chosen in this way. Take the solution of practical problems in industry and mining enterprises as major subjects and create conditions for establishing horizontal, organic networks of contracts; 2) Problems of national significance should be conscientiously entrusted to and managed by national departments. Control should not be divided. These topics require enormous amounts of money, generally there should be no duplication of effort. Those managing departments and leaders who mismanage major research topics due to poor performance or other unnatural factors should be investigated to determine responsibility and punished severely; and 3) In order to maintain staying power and elevate the national S&T level we should encourage and support qualified organizations and individuals to continue positive development of basic research, and welcome foreign scholars. Also we should welcome our own scholars and post-doctoral students who have studied overseas to bring back advanced international subjects for work here. We must decisively resist and strictly criticize the kind of thinking which exists in a minority of leaders and S&T personnel typified by a narrow concern for one's own profit.

Problems of Scientific Research Funding

Scientific research funding is a prerequisite of S&T development. To guarantee the steady development of national S&T, annual funding for scientific research activities should increase slightly after price indexing deductions. China has the following problems pertaining to scientific research funding: 1) Funding of scientific research in proportion to gross national product tends to be low. For many years it was less than 1 percent. Because the per capita income of my country is low, scientific funding seems even more restricted. Add to this, that pricing in the past few years has made it difficult to solve with equal funding S&T problems similar to those of a few years ago; 2) Often the funding which is available cannot be fully brought into play. Despite repeated injunctions from the central government, methods not earnestly implemented, and the original restrictions on the S&T system result in very serious problems concerning repetition of effort on low-level subjects and introduction from foreign sources; and 3) Application and distribution channels for funding of scientific research are plagued by a number of problems. A large number of managers and S&T personnel put their energies into obtaining money. The phenomenon of distributing money according to status is also very common, even to the point that fraud and deception often occur. If matters continue in this manner the atmosphere of scientific research will deteriorate.

24

Problems in S&T Leadership

The selection of S&T leadership (here, primarily institute heads and school presidents) is more critical than the rigorous selection of S&T personnel themselves. Because of this, industrially developed countries place great emphasis of rigorous selection of S&T leadership and middle to upper level managers. Naturally we don't have to mechanically copy foreign methods of selecting managers. But, their principles of selecting and employing quality people can not be disputed. In the past few years, we have encountered many problems in the selection of all levels of S&T leadership. I think the major problems are as follows; 1) The vague distinction between the duties of scientists, managers and businessmen. In the minds of some, people who have been scientists are fully qualified to become managers and businessmen. Thus scholars who have made significant contributions in science are improperly promoted to leadership positions. These people have great difficulty in the complex management environment and can't bring into play the talent of the scientists. Some can only be defeated by this situation; 2) After scientists transfer to positions of leadership in management, they can't transfer their energies from scientific research to management research in time. They lack an in depth understanding of the overall organizational situation. They remain concerned only with their own little world. Some even bring with them a disciplinary prejudice which effects development of related subjects; 3) The process of selection lacks strict assessment and stresses form over substance; and 4) There are far too many S&T personnel moving toward positions in politics. This is also a problem worth considering. Because presently, China still does not have a developed tertiary industry, the major political duty of many organizations is service. Therefore, they need only choose those people who understand policy, serve diligently, justly handle affairs and show enthusiasm in public affairs. Most of these people can be taken from present ranks of political managers. It is unnecessary to draft too many S&T personnel into political duties.

Problems in the Reform of S&T

We must especially promote and encourage creative thinking on the part of S&T personnel. According to my understanding, in the U.S. more emphasis is placed on creative thinking. Students are constantly inspired to develop independent thinking and the spirit of creative thought is promoted. If students only repeat the thinking of their teachers they usually don't score very highly. When any American organization is hiring, especially when they seek critical personnel at any level an organ examination is required. Should they find people with excellent creative or developmental ability they will hire them even at high cost.

In family education the child is required to gradually develop the ability to live independently. When they become adults (generally around 18 after high school graduation they enter the adult world) they are pushed out into society on their own to pursue their careers. Very

few continue to live with their parents or continue to depend on their parent's support. Perhaps they leave home to enter university or find a job. They start down their own road.

At present, in China many places and organizations still lack a creative environment. Many leaders only demand that associates and subordinates obey or honor their opinions. Because of the long-term influence of feudal society, many people are accustomed to this situation. This has caused many creative people all kinds of suffering. Newspapers have reported this often. The tendency toward dependence on parents is also very serious. Many high-level leaders are willing to assist their children even to the point of taking risks on their behalf. This has given rise to the passive attitude in some people that all that is necessary to ensure a good life are good parents.

In S&T, some people fear being surpassed by newcomers. They hope to maintain their prestigious positions without competition to determine who shall sink and who shall swim. This phenomenon is really unsettling.

Problems Concerning Movement of Personnel

The immobility of S&T workers is one of the problems which in recent years has received much attention, but has been actually effected little. This appears in the circumstances of my country to be one of the more complicated problems. The reasons are as follows: 1) The living and working conditions of each region of the country and those elements influenced by them, e.g., marriage, children's education, labor availability, job availability, housing, clothing, transportation, and food differ greatly. These practical problems cause people to fear or be unwilling to relocate in rural areas to work; 2) The existence of "the unit ownership system", "lifelong work assignments", "arranged marriages", etc., hinders the mobility of personnel.

Some people want to change their working environment, however, if it isn't that their organization won't release them, then another won't accept them or their family will not consent. Therefore, nothing is done; 3) We lack an information network and advanced management methods to handle personnel mobility. Public opinion conducive to this mobility has not developed. Some people want to look for a new position, but because they lack information about job vacancies they don't know how to start. Certain people think those who wish to move have either committed some error or are unable to remain in their original organization; and 4) The long-standing unified assignment system for S&T workers has caused personnel departments to become lazy, and neglect their responsibility to advertise vacant positions and urge personnel movement. Therefore, there is still much work to be done in encouraging personnel movement. At the same time we must use effective methods. For example, gradually create conditions for a uniform, basic situation

throughout the country (this should be a basic, guiding principle and a
long-term working method), provide much better compensation for those
comrades who go to rural or remote areas to work, exclude high school
graduates from the permanent assignment system, strengthen channels of
personnel movement and establish a personnel movement data base,
gradually formulate a series of policies to promote personnel movement,
etc. I think that the government and the people need only work hard
together to achieve these objectives.

Problems Concerning Scientific Research Equipment

Pertaining to this, foreign countries have comparatively good methods
which are worth borrowing: 1) Important public facilities are
maintained by specialists and are available year-around, 24 hours a day.
The primary responsibility of these specialists is to maintain the
normal working order of this equipment, thus facilitating its use. Very
few people appropriate the equipment or make excuses to prevent others
from using it; 2) Active creation of conditions which allow everyone
the opportunity to learn about or utilize frequently used or common
kinds of equipment. For example, in the U.S. many departments have
communal-use computer rooms and a large collection of micro-computer
software that everyone can borrow very conveniently; and 3) Pay
attention to equipment modernization. For example, in the past copy
machines, had only single sheet copy function, but later they gradually
developed continuous copy, collating and the capability to input user
names. This allows the machines to be started and stopped, count
numbers and calculate accounts all in accordance with previously
compiled numbers. This is very convenient. Outsiders can be prevented
from using the machines.

China still has many problems in these areas: 1) Some departments or
individuals all for practical purposes take large high precision
instruments belonging to the district or department for their own use.
This causes multiple orders for large high precision and high cost
instruments from many organizations. Money is wasted and the equipment
is not fully utilized. Some equipment is not ruined through use, rather
it is ruined through neglect (e.g., rusting through lack of use); 2)
Technical training lags behind software inventory. Full utilization of
the potential of new instruments often requires specialized technical
training. Computers especially require a complementary software
inventory. According to a study done a few years ago in Shanghai and
Beijing, only one-third of existing computers are utilized comparatively
well, another one-third are not utilized to their full potential, and
the potential of the remaining one-third is basically unused because of
many factors. In China the number of computers is very small. Many
people don't have the chance for hands-on practice or use. Still, many
existing computers sit idle or are not used to their full capability. A
similar situation exists with the use of other equipment. This is
confirmation that the standard of management is low; and 3) Information
flow between this and other countries concerning instruments and
equipment is lacking, creating all kinds of unnecessary loses. For

example, equipment is purchased, which is incompatible and can only be
set aside. Some domestically produced instruments can fully take the
place of imported equipment but foreign exchange continues to be wasted.
less sophisticated equipment would be adequate, but high precision
equipment is purchased.

There is some multi-function equipment utilized for only one function.
Some equipment orders take so long to arrive that research subjects have
changed by the time equipment is available. Some items arrive before it
is realized that the specifications are incorrect. All of these are
important factors in creating waste and accumulation of scientific
research equipment.

Problems Concerning Appraisal of Achievements

Achievements are the crystallization of S&T worker's diligent labor.
They should be judged objectively and fairly. Appraisal of results is
presently a major process in my country's management of achievements.
Many organizations are not concerned with production cost, they are
concerned only with appraising results well. But the current method of
relying primarily on the judgment of face to face appraisal meetings
seems to have many shortcomings: 1) Evaluations are not accurate.
Some organizers of appraisal meetings tend not to allow the attendance
of people with opinions different from their own. Some use authority
little related to the results being evaluated or administrative
officials to control the situation . Some use excellent monetary
incentives to deep people quiet. All of these could possibly create an
inaccurate assessment of results; 2) Working styles are unhealthy.
Some organizations or individuals enthusiastically entertain, give gifts
and souvenirs, organize amusement, invite other to cultural activities,
etc. This both damages the country and perpetuates an unhealthy
atmosphere; and 3) Wasting of money. Besides information costs and
venue costs, the average appraisal conference also has very large travel
expenses. Representatives traveling back and forth from places far from
the meeting center waste money, time, energy and increase transportation
tension nationwide. Cost of one appraisal conference may be as low as
several hundred yuan or as high as several thousand, even over ten
thousand yuan. With all the organizations nationwide convening so many
such meetings, the expense is enormous.

According to my understanding, the U.S. does not use this appraisal
meeting method. Their achievements primarily rely on the natural
acknowledgment of society. Theoretical results are compiled into essays
and issued through relevant specialized journals. Applied achievements
can also be summarized into essays and technical reports and published
in appropriate journals or appraisal can come from organizations
utilizing the results and from evidence of social or economic benefit.
Feedback ban be obtained on achievements of technologically secret work
or work related to the military from management departments. In brief,
all kinds of accomplishments can obtain the acknowledgment of society,

it is only a matter of when. The U.S. has a journal which specializes
in statistically evaluating the number of times an article is cited by
other scientists and from this analyzes and judges the article's value.

Based on the above analysis I suggest: 1) In principle, these popular
appraisal conferences which are so enormously wasteful of funds, which
cause transportation tension and have other shortcomings should be
canceled. This would allow S&T and management personnel to concentrate
their energies on the key technical and managerial problems in
scientific research, simultaneously saving a great deal of labor and
material and financial resources; 2) Incentives for S&T workers should
primarily consist of continuous salary increases and creation of better
future working conditions, etc. Incentives should not depend on one or
two small bonuses; and 3) After promotion and application of S&T
results which are highly useful in the economy, relevant S&T workers can
obtain material benefit directly from the factory. Other workers need
not be made jealous.

Popularization of Scientific Topics

The industrially developed capitalist countries of Europe and America,
for the most part, place more emphasis on popularizing science and
elevating the people's level of scientific culture. The governments
take appropriate measures and great effort to guarantee realization of
this objective. The history of scientific development in every country
indicates the popularization of science provides the conditions for
elevation of the nation's scientific level. Because of this, we must
earnestly take measures to achieve scientific popularization: 1) First
at the pre-high school level we must do our best to popularize science
on a nationwide scale. For many reasons, presently in rural areas there
is still a large group of school age children who can't enter school or
who only study a few years before quitting and staying home. Among
these children, the percentage of girls is higher. Only through
education can we guarantee the continued availability of S&T talent.
Only if we offer more people the opportunity for education can we
cultivate more highly talented people. Although there are some very
intelligent illiterate or semi-literate people, it is very difficult for
them to become outstanding scientists; 2) Based on the actual living
conditions of our people (especially rural residents) we should use all
possible methods to disseminate compulsory, tuition-free primary and
secondary education and lend textbooks free of charge. We only need
give the problem some consideration in order to solve it without
increasing national expenditures. For example, at the high-school
level, textbooks are updated yearly. They are only used for one
semester then discarded. This creates enormous waste and increases
family expenses. We should on a national, provincial, or municipal
scale select or uniformly compile a set of textbooks and reference works
for all grade levels. Then lend them without charge or rent them for a
small fee. Thus we can actually achieve compulsory education. Some
parents respond that after Shanghai instituted a compulsory education
system, student's expenses increased. This should not happen. I think

consolidation of textbooks and all kinds of reference books will save enough money to provide teachers and students with teaching materials at no charge; 3) Strengthen propagation of science dissemination. Rectify existing museums and all kinds of S&T exhibitions to provide free (or low cost) year-round service. All types of exhibitions, museums and S&T museums should incessantly supplement their material with new content, and also often invite all levels of students to come and receive science education; and 4) Based on the ratio of professors to students in the universities of my country (less than 1:4) the capacity to recruit more students is great. In most countries this ratio is about 1:10. Based on our existing university foundation it is possible to properly expand the number of students and raise the proportion of high school and university students in the population. The primary problem is inadequate student housing. In other countries students' room and board are basically the responsibility of society. In China this is handled by the school, naturally causing much difficulty. We can use a number of measures to solve this problem. For example, city universities could increase the number of non-resident students. Universities outside the city could raise funds to build apartments to rent out. Thus gradually increasing the number of students. We must work hard to raise the level of scientific culture among the people.

Management is a task with implication for the overall situation. Management is relied upon to adjust the relationship between S&T, the economy and resources. The full utilization of national resources (including introducing foreign investment) to develop advanced S&T and the use of modern S&T to promote economic development, thus elevating both the people's living standard and the positive nature of work, are the primary duties of managers. Managing advanced S&T with advanced management methods is the task which now faces us. It is apparent that the potential of my country's management is very great. Based on it's resources and the traditional quality of its people, we need only work hard to improve management and reduce major policy errors. Thereby creating conditions to accelerate development and to soon enter the ranks of the advanced nations.

12223

Progress Noted in S&T Research Funding Reforms

40080014 Tianjin JISHU SHICHANG BAO in Chinese 13 Aug 88 p 1

[Article: "The Restructuring of Operating Expenses for China's Science Research Attracts Attention"]

[Text] Recent statistics from various sectors of the state show that the restructuring of scientific research operating expenses has made great advances. An analysis of the restructuring of expenses, tasking, and internal management for 5,222 independent research organizations in natural science fields in departments at the county or higher level holds that lateral income generation for China's S&T organizations has grown quickly, already clearly exceeding appropriations for government science research operating expenses.

The total income in 1987 including government allocations for these organizations together with funds laterally generated came to 10.3 billion yuan, among which government allocations were 670 million yuan and laterally generated income 360 million yuan. Laterally generated income was 35 percent of the total revenue, an increase of 31 percent over the 270 million yuan of 1986, and 1.5 times the 250 million yuan allocated by the government for science research operating expenses. The average annual laterally generated income for each organization was 700,000 yuan, or about 3,000 for each staff member.

Among laterally generated income, income from technology grew rapidly. Last year, income from technology was 240 million yuan (essentially equivalent to that year's science research operating expenses as allocated from government funds), which was a growth of 45 percent over the 160 million yuan of 1986. This trend shows clearly that among activity in the technology economy, science research organizations are maintaining the direction of focusing on technology development activities.

At the end of last year, there were 2,443 independent research development organizations throughout the country that had reduced their funds for research operating expenses, which accounted for 46.8 percent of the total number of such organizations. Considering current progress regarding the restructuring of funds for operating expenses and the situation whereby research and development organizations laterally generate income and other organizations might keep a portion of their research funds, the 1990 restructuring measures calling for a reduction of funds for research can be implemented with great effort, but there will have to be an appropriate quickening of the pace.

31

In recent years, the number of research development topics and the intensity of investment for China's research organizations have been growing steadily. Last year, there were a total of 114,000 projects undertaken and investment of 3.13 billion yuan, where funds invested for research topics grew 37.3 percent over 1986. This situation shows that at the same time as research organizations maintain their emphasis on technology development activities, they are also paying close attention to their technology reserves.

Departments of the State Council and locally affiliated organizations each have their particular characteristics. Organizations affiliated with departments of the State Council have been slower than locally affiliated organizations in the pace of reducing allocations for research funding, but their progress in aspects of the restructuring of internal management in areas such as implementing the institute director responsibility system, the project contract system, and the project economic accounting system has been somewhat greater. By the end of last year, research and development organizations implementing the institute director responsibility system or the term goal responsibility system were 51.3 percent of the total number. There were 1,950 locally affiliated organizations doing the same, or 46.6 percent of their total. A total of 2,666 organizations implemented the project contract system, or 51.1 percent of the total, where 2,057 local groups did the same, or 49.1 percent. A total of 2,993 organizations adopted project economic accounting, or 57.3 of the total possible, while locally 2,235 groups did the same, or 53.4 percent of the total possible. Looking at the situation in terms of funds allocation, of the 6.7 billion yuan allocated as funds by the government in 1987, 4.8 billion yuan went to State Council affiliated organizations, or 71 percent, while 1.9 billion yuan went to locally affiliated organizations, or 29 percent. This situation shows that during restructuring, locally affiliated organizations have played an outstanding leading role in the growth of local economies, doing so quite vigorously. The real power of State Council affiliated organizations is quite substantial, and they are a principle part of both the aspect of government funding and also of laterally generated income. Their progress in the restructuring of their internal economic management for research organizations has been greater, but their potential has yet to be realized. The problem surfaces apart from the factors of the heavy burden of large academies and institutes and the difficulty in making things first-class, and is rather in somewhat weak coordination between management departments and the other departments, or in the greater difficulties they have over those of the local areas.

12586

Shanghai Plans Caohejing Economic-Technological Development Zone

40100004 Beijing BEIJING REVIEW in English 22 Aug 88 pp 7-8

[Text] We believe that the newly established Shanghai Caohejing Economic-Technological Development Zone will create an advanced industrial area with a better investment climate, high efficiency and a pleasing environment, and its formal founding is sure to contribute much to the regeneration of Shanghai, Vice-Mayor Liu Zhenyuan says.

Liu, director of the group responsible for the zone's planning and construction, announced on July 23 that the State Council has approved the city's decision to upgrade the Caohejing Microelectronic Industrial Park into Shanghai's third economic-technological development zone. Resident companies will enjoy the same preferential treatment as those in the Minhang and Hongqiao zones.

The Caohejing Economic-Technological Development Zone aims to develop high-technology industry by making the optimum use of Shanghai's scientific and technological resources, as well as foreign investment and advanced technology. Ye Bochu, vice-chairman of the Shanghai municipal people's congress, outlined the four basic functions of the zone. They are: first, to attract international hi-tech businesses to set up subsidiaries or joint ventures with Chinese partners; second, to encourage Chinese research institutes to establish enterprises that turn research findings into products; third, to follow the lead of Zhongguancun--"Electronics Street"--in Beijing by making the zone a base for the development and exchange of new technology; and fourth, to build the zone into an "invention centre" where individual and collective inventions or innovations will be encouraged and developed into products. Ye told the press conference that provisions concerning the zone will be soon worked out and passed by the municipal people's congress.

The decision to set up the Caohejing Microelectronic Industrial Park was made in November 1984. The municipal government saw it as a means to attract foreign investment and introduce advanced technology to develop hi-tech industries. Construction of the industrial park started in September 1986. The infrastructure has been completed and regular supplies of water, electricity and gas are guaranteed. Businesses including Shanghai Philips Semi-conductor Co. Ltd., Shanghai Sino-French Liquid Air Co. Ltd., 3M China Ltd., Shanghai Optical Fibre Communication Engineering Corp. and the

microelectronic branch of the Shanghai Metallurgical Research Institute of the Academy of Sciences of China are setting up on the site with a total investment of US$120 million, of which US$55.11 million is foreign investment.

The Caohejing Economic-Technological Development Zone (also known as the Hi-Tech Development Zone) has a planned area of 5 square kilometers, compared with the industrial park's original 0.57 square kilometres. The site is at the southwest edge of Shanghai, about 11 km from the People's Square in the heart of the city and 7 km from Hongqiao International Airport. The zone is surrounded by a dozen or more institutions of higher learning, including Jiaotong University, and several dozen research institutes including the Shanghai Metallurgical Research Institute. The Shanghai No 1 Television Factory, Sino-US Foxboro Ltd. and more than 30 other companies specializing in electronics, instrument making, communications and space technology are located within the planned area of the zone. The area's infrastructure, rich intellectual reserves, industrial support, convenient transport, fresh air, clean water and low noise are considered to make it an ideal place to develop hi-tech businesses.

"The formal founding of the zone indicates China's determination to develop its microelectronic and other hi-tech industries," said Qi Minsheng, president of the Caohejing Hi-Tech Development Zone Development Corp. "I'm proud to say that our development zone is attractive and competitive for both overseas and domestic investors."

The Minhang zone chiefly features a rich variety of regular processing and manufacturing industries, while the Hongqiao zone mostly leases land for service businesses. The Caohejing hi-tech zone will be reserved for hi-tech companies in fields such as microelectronics, information engineering, optical fibre-digital communication, laser technology, bio-engineering technology, space technology, precision instruments and electronic equipment.

09986

34

Sino-Italian Joint Effort Results in Upgrated A-5M

40080026c Nanchang JIANGXI RIBAO in Chinese 1 Sep 88 p 1

[Text] XINHUA, Nanchang, 31 Aug--The A-5M aircraft, a joint venture by China and Italy, made its initial flight yesterday at Nanchang, demonstrating such capabilities as steep dives, rapid acceleration, and precision loops and turns. The aircraft is now being put through a systematic test flight program.

The aircraft represents a new generation of attack fighter and is a modified version of the Q-5. Its electronic navigation and fire control systems have been provided by the Italian Aircraft Corporation's [Aeritalia?] Electronic Equipment Division, which also developed these systems. The Nanchang Aircraft Manufacturing Company is responsible for the production of two prototypes. The China Aero-Technology Import-Export Corporation [CATIC] has been participating in this joint effort for the past 2 years.

Compared to the Q-5 currently being exported, the A-5M has upgraded navigation equipment and attack and penetration capabilities along with improved defensive capability and more reliable equipment overall, bringing the aircraft up to international standards.

07310

Electron Spin Resonance Properties of Amorphous Silicon-Based Alloy Films at High Temperatures

[English abstract of article by Chen Guanghua [7115 0342 5478], et al., of the Department of Physics, Lanzhou University]

[Text] In this paper, the authors first investigated some important properties of high temperature electron spin resonance (ESR) of doped (B and P) and undoped $a-Si_{1-x}C_x:H$ and $a-Si_{1-x}N_x:H$ alloy films. The ESR measurements were performed continuously in a high temperature annealing process. The experimental results show that:
(1) For B-doped $a-Si_{1-x}C_x:H$ and $a-Si_{1-x}N_x:H$ films, an ESR absorption line can be decomposed to a broad ($g_1 = 2.005$) and a narrow ($g_2 = 2.010$) ESR absorption line, with g_1 and g_2 corresponding to the contributions of Si dangling bonds and of holes in the valence band tail states, respectively.
(2) The hole density drop in the valence band tail states is faster than Si_3^0 with a rise in temperature. The hole density in the valence band tail states is larger than Si_3^0 when the temperature is low. However, the contribution of Si_3^0 is the main one when the temperature is very high.

9717

Thermomagnetic Effect of Sm-T (T=Fe, Co) Amorphous Thin Films in High Fields

[English abstract of article by Fang Ruiyi [2455 3843 1355], et al., of the Department of Physics, Beijing University]

[Text] The temperature dependence of magnetization at $H = 0.1-7$ T for amorphous Sm_xTi_{1-x} (T = Fe, Co) thin films was investigated in the range of 1.5 to 300 K. It was found that there was a maximum magnetization in the $\sigma(T)$ curves, measured during the temperature rising process, for the Sm_xCo_{1-x} thin films ($x = 0.46, 0.48, 0.54, 0.65$). For the Sm-Co alloys, the temperatures corresponding to σ_{max} are about 25-28 K and are independent of the composition. However, the Sm-Fe amorphous alloys are different from the Sm-Co alloys—in the former, the temperature corresponding to σ_{max} depends on both the field and the composition of the alloys. In addition, it was found that there was a σ_{min} (or a repaid variation) at $T \approx 6$ K, and $\sigma(T)$ decreased very slowly near room temperature.

It was suggested that the thermomagnetic effect for the Sm-Co thin films at high fields may be caused by the contribution of the Sm moment to the magnetization, although the magnetic moment of Sm atoms is very small ($\approx 0.1 \mu_B$), and the random local anisotropy is strong at low temperatures and changes significantly between 20-30 K. However, the thermomagnetic effect of the Sm-Fe amorphous alloys may be caused by the dispersion of the Fe moments. The σ_{min} at $T \approx 6$ K and the slow decrease of $\sigma(T)$ near room temperature may be caused by the composition fluctuation in these alloys.

9717

Theory of Ultrasonic Attenuation in Superionic Glasses

[English abstract of article by Wang Yangpu [3769 7402 3877], et al., of the Department of Physics, Suzhou University]

[Text] According to IRD theory, the authors studied the infrared divergence response in superionic glasses resulting from mang-body interactions caused by the presence of disorder. Based on a new relaxation mechanism, the authors revised the rate equation of anelastic strain and then, using the Boltzmann superposition principle, derived the formula for ultrasonic attenuation with IRD. From this, the power law dependence of ultrasonic attenuation on the frequency $a \propto \omega^n$ on the low temperature side and the apparent activation energy E_A^* are obtained. They are in agreement with the experimental data for superionic glasses $(AgI)_x(Ag_2O \cdot nB_2O_3)_{1-x}$.

9717

Electron Stimulated Desorption Study of Oxygen on Nickel

[English abstract of article by Guo Yuanheng [6753 0337 1854], et al., of the Beijing Vacuum Laboratory, Chinese Academy of Sciences, and the Department of Physics, Beijing University]

[Text] Electron Stimulated Desorption (ESD) of O^+ from a polycrystalline Ni surface was studied. The ESD O^+ was measured after the Ni sample was annealed at 700°C for 2 hours and then exposed to 20-60 L O_2 at room temperature and 500°C, respectively. Two kinds of ESD O^+ have been found with different electron energy thresholds (29 eV and 23 eV). It is concluded that the two O^+s occurred due to Auger induced desorption and the two thresholds corresponded to the $O(2s)$ electron ionization energy and excitation energy respectively. The process of excitation, ionization and de-excitation is also discussed.

9717

Doping Effect in a-Si:H/a-SiN$_x$:H Superlattices

[English abstract of article by Wang Shulin [3769 2885 2651], et al., of Shanghai Institute of Ceramics, Chinese Academy of Sciences]

[Text] A new class of a-Si:H/doped a-SiN$_x$:H superlattices with fixed sublayer thicknesses and NH$_3$/SiH$_4$ ratio, but with varying gaseous doping levels in a-SiN$_x$:H sublayers, has been synthesized by using the equipped shutter deposition system. It is shown that the position of the Fermi level in superlattices can be controlled through doping in a-SiN$_x$:H sublayers, i.e., the a-Si:H/a-SiN$_x$:H superlattices can be changed from the n-type to p-type depending on the B doping level in the a-SiN$_x$:H sublayer. However, the transport property of a-Si:H/a-SiN$_x$:H superlattices is not affected very much by the P doping in a-SiN$_x$:H sublayers.

9717

Ferromagnetic Resonance of Cylindrical Domain Lattice

[English abstract of article by Bi Siyun [3968 1835 0061] of the Department of Physics, Shandong University, Jinan]

[Text] Recent experimental work on the ferromagnetic resonance of a cylindrical domain lattice during arbitrary magnetic field action is reported. The device used in the experiments is a microwave microstrip transmission line placed between the poles of a electromagnet. Based on the experimental results, the present theories on bubble mode resonance are analyzed, and some significant results are achieved.
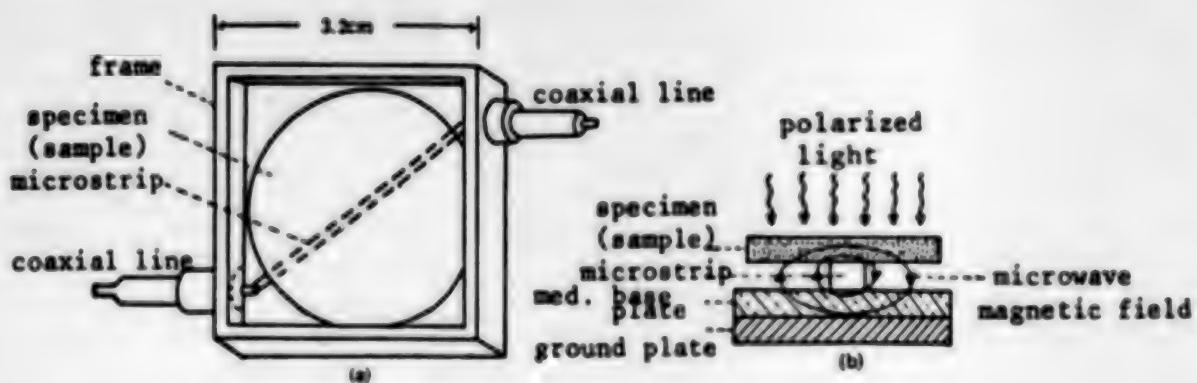
9717

Alternating Current Properties Analysis of Superionic Conductors

[English abstract of article by Ding Yi [0002 1473], et al., of the Department of Physics, University of Science and Technology of China, Hefei]

[Text] Superionic conductors exhibit non-Debye behavior of solid dielectrics at low frequencies ($f < 10^9$ Hz). Based on the characteristics of superionic conductors and a physical picture of Ngai's infrared divergent theory, the authors believe the fast ion transport to be a non-Markovian process and have analyzed the alternating current properties of superionic conductors. The theory predicts that the admittance diagram is a line, the curvature of which is less than one at higher frequencies. The discrepancy between the theory and experiments at lower frequencies is due to interfacial effects.

9717

Observation, Measurement of Fragmentation Event of Relativistic Oxygen Nucleus, Explanation of Mechanism

[English abstract of article by Tang Xiaowei [0781 1321 1218], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing]

[Text] A nuclear emulsion stack bombarded by 200 GeV/nucleon oxygen nuclei has been analyzed and the measurement of a ternary fragmentation event of a relativistic oxygen nucleus into 3 helium nuclei and 22 minimum ionizing particles has been performed. The mechanism of the fragmentation processes is discussed. The fragmentation phenomena of the relativistic oxygen nuclei provide direct experimental evidence for the cluster model of the oxygen nuclei.

9717

Analysis of Antiproton-Nucleus Elastic Scattering

[English abstract of article by Li Yangguo [2621 2254 0948] of Shantou University, Guangdong]

[Text] The antiproton-nucleus elastic scattering differential cross section of ^{12}C, $^{14,16}O$, ^{40}Ca and ^{208}Pb at incident energies 50 MeV and 180 MeV has been calculated and analyzed by optical potential. It is shown that the antiproton optical potential has strong absorption characteristics. In analyzing the optical potential parameters to best fit the experimental data, it has been found that the diffuseness parameters can vary only in a narrow region and increase with heavier nuclei. These optical potentials have shallow real parts. The absorption coefficients approach zero inside the target nucleus, so the elastic scattering takes place at the surface region of the nucleus.

9717

Analysis of Performance of New Type of Linear Periodic Magnets

[English abstract of article by Xu Jianming [1776 1696 6900], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing]

[Text] In this paper, the performance of a new type (modulating width type) of linear periodic magnet is analyzed. In an ideal two-dimensional case, the field produced by this type of magnet would be purely sinusoidal. A soft iron shield can be used to strengthen the magnetic field and, in some cases, the strengthening factor is larger than two.

The expressions of the field distributions in the ideal case and in the real case are given, as is the strengthening factor expression. Methods for reducing undesirable harmonics in the magnetic field are also discussed in this paper.

9717

New Type of Ionization Chamber Telescope

[English abstract of article by Li Songlin [2621 2646 2651], et al., of the Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou]

[Text] A new type of ionization chamber telescope is introduced which consists of two ionization chambers in series followed by a position sensitive semiconductor Si detector. The trajectory of the incident particles is parallel to the direction of the electric field in the ionization chamber. The advantages of this type of detector are as follows: (1) its wide dynamic range permits resolution for light particles as well as heavy elements; (2) its good position resolution makes it possible to cover a large solid (subtended about 14°) with a relatively small detector size.

9717

Emission of Light Particles in Heavy Ion Collisions

[English abstract of article by Wu Guohua [0702 0948 5478], et al., of the Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou]

[Text] Using the numbers of excited particles and holes calculated by dissipative diabatic dynamics (DDD) as the initial exciton number n , the energy spectra and angular distributions of emitted light particles for $^{40}Ca + ^{40}Ca$ and $^{58}Ni + ^{58}Ni$ at different bombarding energies are calculated based on the fast particle exciton model and are compared with other models.

9717

Semiconductor Septum Electrochemical Photo Cells. I. Characteristics of
Electric Power Output

[English abstract of article by Xiao Ke [5135 4430] of the National Laboratory
for Interfaces Science]

[Text] In this paper, using photo-electrochemical methods, the power output
characteristics of a CdSe semiconductor septum electrochemical photocell
(SC-SEP) has been studied. For E_1/Na_2S, $NaOH//CdSe//AgNO_3/E_2$ SC-SEPs,
electrodes of Cu_2S, Pt, Cu, Ag, Ti and SCE were used respectively for the E_1,
E_2 power output. The real photoelectrochemical conversion efficiency is
larger than that of the photo-electric power conversion since the SC-SEP cell
has a photovoltage higher than 1.9 V and its photochemical energy conversion
always occurs with the power output. Twenty-five examples of I-V power output
behavior are also given.

9717

Semiconductor Septum Electrochemical Photo Cells. II. Double Liquid Junction
Barrier Injection, Transit Photoelectrochemical Effects

[English abstract of article by Xiao Ke [5135 4430] of the National Laboratory
for Interfaces Science]

[Text] In this paper, a CdSe SC-SEP (semiconductor septum electrochemical
photo cell) with a high open circuit voltage of 1.96 V is reported. To
further explain why SC-SEPs have higher voltage than that of the Band Gap (E_g)
of the semiconductor septum materials, the mechanism of double liquid junction
barrier injection and transit photoelectrochemical effects is introduced.
Based on this theory, measures to increase the photovoltage and photocurrent
are discussed.

9717

Semiconductor Septum Electrochemical Photo Cells. III. Time Characteristics
of Photovoltage

[English abstract of article by Xiao Ke [5135 4430] of the National Laboratory
for Interfaces Science]

[Text] A mathematical model of a two-step flowing system is used for simulat-
ing the photovoltage-time response characteristics of a CdSe SC-SEP (semi-
conductor septum electrochemical photo cell). The relationships between the
light density and the time constant of the photovoltage response and to the
photovoltage itself are discussed. A new photovoltage value of 2.087 V and
photocurrent of 30 mA/cm^2 have been recorded for a multi-etched CdSe SC-SEP
under light density of 200 mW/cm^2.

9717

Semiconductor Septum Electrochemical Photo Cells. IV. Hydrogen Manufacture
of Water Photoelectrolysis by Star Cell

[English abstract of article by Xiao Ke [5135 4430] of the National Laboratory
for Interface Science]

[Text] A star-type photoelectrolytic cell based on the CdSe SC-SEP (semi-
conductor septum electrochemical photo cell) has been studied to photodecompose
water to produce hydrogen and oxygen by using 300 mW/cm^2 visible light. The
maximum cell voltage is 2.1 V, short circuit photocurrent is about 10 mA/cm^2
and the hydrogen generation rate is about 1.20 ml/h·cm^2. The ratio of the
hydrogen and oxygen gas volume is 2.02:1. The total efficiency of the star-
type photolysis cell is near 10 percent, while the conversion efficiency of
hydrogen production is about 2 percent.

9717

Semiconductor Septum Electrochemical Photo Cells. V. Diversified SC-SEPs, Thin Semiconductor-Metal Septums

[English abstract of article by Xiao Ke [5135 4430], et al., of the National Laboratory for Interfaces Science]

[Text] In this paper, the experimental results of diversified thin film CdSe/Ti/CdSe septums prepared by rolling, coating and electrodepositing methods are reported. The photovoltaic cells mentioned above have obtained voltage as high as 1.2-1.35 V and photocurrent of 11-29 mA/cm^2 under 100 mW/cm^2 light intensity. The structures of different SC-SEPs (semiconductor septum electrochemical photo cells) are discussed.

9717

Plasma-Enhanced CVD Silicon Nitride as Antireflection Coating for Silicon Solar Cells

40090008f Beijing TAIYANGNENG XUEBAO [ACTA ENERGIAE SOLARIS SINICA] in Chinese Vol 9 No 3, Jul 88 pp 286-290

[English abstract of article by Mao Ganru [3029 6373 1172], et al., of the Electronics Department, Tianjin University]

[Text] Using plasma-enhanced chemical vapor deposition (PECVD), the use of silicon nitride film as an antireflection coating for silicon solar cells is reported. The components and characteristics of the film have been studied by means of infrared spectroscopy, Auger electron spectroscopy, ellipsometry and C-V measurement. Multilayer SiN films with different refractive indexes have been prepared according to the SiN index changes accompanying processing conditions. The experiment results show that the cell conversion efficiency increases by 38 percent following the application of the silicon nitride AR coating. The average reflectance of the four-layer AR coatings is less than 5 percent (spectral range 400-1100 nm).

9717

Design of Spacer Grid of PWR Fuel Assembly for Qinshan Nuclear Power Plant

[English abstract of article by Zhang Jiahua [1728 1367 7520], et al.]

[Text] The spacer grid of the PWR fuel assembly for the Qinshan Nuclear Power Plant is a spring structure with a 15 x 15 square array. Each fuel rad is literally supported at six contact points in each cell of the grid by the combination of fixed dimples and spring straps. The design basis and requirements are presented, and the results of the calculations and experiments are discussed. A design evaluation of the grid in terms of nuclear, thermal-hydraulic and mechanical aspects has been made. The analysis shows that the performance of the grid meets all the design requirements.

9717

Metallic Fuels, Blankets in Liquid-Metal Fast Breeder Reactors

[English abstract of article by Sheng Zhaoqi [4141 0340 3825]]

[Text] A series of loss-of-flow without scram and loss-of-heat sink without scram tests was successfully conducted in EBR-II during 1986. The EBR-II tests represent a significant milestone on the path to demonstrating the inherent safety characteristics of the liquid metal cooled reactor power plant. The use of U-Pu-Zr metallic fuel has been the key to the inherent safety and economic characteristics, as well as high breeding ratios. A closed fuel cycle based on pyrometallurgical reprocessing and injection casting refabrication can be colocated with the reactor plant if desired. Waste volumes are also reduced and can be put in final form in-plant. Therefore, renewed interest in metallic fuels for LMFBRs has understandably arisen.

9717

Refinement of Grain Structure in A508-3 Steel

[English abstract of article by Sheng Zhongqi [4141 6988 3823], et al.]

[Text] The prior austenite grain size, bainite colony size and average grain size after intercritical quenching in A508-3 steel have been measured, and factors affecting them are discussed. The results show that a small amount of aluminum can induce a serious mixed structure with fine and coarse grains in the prior austenite. A fast cooling rate will give a fine bainite colony and a very fine grain structure can be obtained through intercritical quenching.

9717

Determination of Bulk Density of UO$_2$ Granular Material by Dewatering Method in Centrifugal Device

[English abstract of article by Zhang Huiying [1728 1920 5391], et al.]

[Text] This paper introduces a determination method of density for fine granular materials. It is appropriate for determining the bulk density of a ceramic granule of over 300 μ. The authors have determined the bulk densities of five different UO$_2$ granules. The relative standard deviation is 0.16 percent in the determination of bulk densities, with accuracy within 1 percent.

9717

Corrosion Behavior of Stainless in High Temperature Sodium Under Tensile Stress

[English abstract of article by Xu Yongli [6079 0737 7787], et al.]

[Text] This paper presents the tensile stress which influences the corrosion behavior of the LMFBR's cladding materials in high temperature sodium. A series of Cr13Ni17Mo3W austenitic steel, developed by Japan, was studied, and its corrosion resistance was compared with that of AISI 316SS under the same experimental conditions. A stress testing facility for high temperature sodium was used in this experiment. The specimens were exposed to sodium at temperatures of 600°C under tensile stress of 0-176 MPa for 500 hours.

The experimental results show that when the stress applied to the speci~ was less than 117 MPa, there was no effect on the corrosion resistance a internal microstructure of the materials, however, when the stress was increased to 176 MPa, a sufficient effect occurred. The corrosion resistance of Cr13Ni17Wo3W3 is better than that of 316SS. On the other hand, the corrosion resistance of Cr13Ni17Wo3W steel is related to the tungsten content in the material. The optimal tungsten content is approximately 1-2 wt percent.

9717

Studies of Linear Polyethers as Extractants.   III. Extraction, Extraction
Chromatographic Separation of Am(III), Cm(III) by N,N,N',N'-Tetraphenyl-3,6-
Dioxaoctane Diamide

[English abstract of article by Zhu Baizhi [2612 2672 2655], et al., of
Northwest Institute of Nuclear Technology, Xi'an; Xu Junzhe [1776 3182 0772],
et al., of Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences]

[Text] The solvent extraction of Am(III) and Cm(III) from picric acid solution
by a nitrobenzene solution of N,N,N',N'-tetraphenyl-3,6-dioxaoctant diamide
has been investigated and compared with the extraction of cerium, neodymium and
europium. The composition of extraction complexes may be represented as ML_2Pic_3.
The distribution ratio decreases with an increase in temperature. In all the
cases studied, the distribution ratio of Am(III) was higher than that of Cm(III).
The average separation factor value was 3, increasing to 5.6 when DTPA was
added during the aqueous phase. This system has been applied to extraction
chromatography, with good separation between Am(III) and Cm(III).

9717

Determination of Hydrogen, Deuterium, Tritium, Helium, Oxygen, Nitrogen, Carbon Monoxide in Gas Mixture by GC-GCMS

[English abstract of article by Deng Zhongguo [6772 0022 0948], et al., of the Institute of Atomic Energy, Beijing; Jing Kangcai [5427 1660 2088], et al., of PO Box 345, Chengdu, Sichuan]

[Text] The use of the combination of gas chromatography (GC) and gas chromatography-mass spectrometry (GCMS) in the determination of hydrogen, deuterium, tritium, helium, oxygen, nitrogen and carbon monoxide in gas mixtures is described. The precision and accuracy is 1.5-2.0 percent for a 10 ml sample of the gas mixture. The ratios of the atomic ions to molecular ions in the HD, HT and DT molecule can be obtained by GCMS. It is found that the ratios of H^+/HD^+ and D^+/HD^+, H^+/HT^+ and T^+/HT^+, and D^+/DT^+ and T^+/DT^+ are not equal, and that the separation characteristic of HT and D_2 is poor when CO is present in the gas mixture.

9717

Study of Source of Optical Activity. I. Gas Chromatographic Analysis of Radiolytic Products of Ethanol, Optical Isomers of 2,3-Butanediol

[English abstract of article by Wang Wenqing [3769 2429 3237], et al., of the Department of Technical Physics, Beijing University]

[Text] Three space conformations of 2,3-butanediol coexist in d-, l-, meso- and dl-isomers. It has been reported that the meso- and l-2, 3-butanediol in grape vine and liquor have been quantitatively measured by gas chromatography with a packed column. The resolving power between the meso- and dl-isomers is less than 0.05 and, consequently, there is a partial overlap between the two peaks.

In this paper the meso- and dl-2,3-butanediol optical isomers are separated and measured through capillary column gas chromatography. The resolving power between meso- and dl-isomers is 1.5, and the heat of solution of dl- and meso-2,3-butanediol is measured, with $\Delta H_{dl} = -49.0$ kJ/mol and $\Delta H_{meso} = -50.8$ kJ/mol, respectively.

Using the gas chromatographic method, the authors have found 2,3-butanediol and the ratio of its meso- and dl-isomers formed in pure ethanol, deaerated with N_2 gas and irradiated with γ-rays, β-rays and electric discharges.

9717

Chemical Purification, Mass Spectrometry of Enriched Boron Isotopes

[English abstract of article by Fu Shuchun [0265 3219 4783], et al., of the Institute of Atomic Energy, Beijing]

[Text] A method is described for the chemical purification and mass spectrometry of enriched ^{10}B and ^{11}B, separated by the electromagnetic method, and some measures are taken to increase the analytical sensitivity and stabilization of the ion beam in the isotope mass spectrometry of a micro amount of solid boron.

9717

Chinese Claim Breakthrough in Neutron Generator Technology

40080012a Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Aug 88 p 1

[Article by Zhou Deguang [0719 1795 1639] of the Xinghua News Agency from Lanzhou on 28 Aug: "High-Current Neutron Generator Developed in China"]

[Text] China successfully developed a world-class high-current neutron generator capable of delivering 3.3×10^{12} neutrons/sec. This accomplishment shows that China has made a major technological breakthrough in neutron generators.

This 10^{12} neutrons per second high-current neutron generator was successfully developed by the Modern Physics Department of Lanzhou University and the Nuclear Institute. It was certified by the government.

The certification committee feel that the major technical specifications of this neutron generator have reached advanced levels for similar generators.

This 3.3×10^{12} neutron generator has found significant applications in the research of materials for fusion and hybrid reactors, reinforcement of radiation resistance of electronic devices, and measurement of nuclear parameters.

This neutron generator can also provide fast neutrons for cancer treatment.

12553/7310

Hybrid Cell Line Producing Anti-PreS2 Monoclonal Antibody for PreS2 Antigen

[Article by Xia Meng-qi, Ji He-ping, Meng Qin, Li Xin-fu and Tao Qi-min;
Institute of Hepatology Beijing Medical University, Beijing]

[Text] After one successful fusion of murine spleen cells, immunized with
hepatitis B virus (HBV) particles bearing polymerized human serum albumin
receptors (PHSA-R) with myeloma cells (SP2/0), a stable hybrid cell line
monoclonal antibody (McAb) was established. The McAb, specific for PreS2
antigen of HBV, can inhibit PHSA-R activity on HBV, and may probably be
antibody against PHSA-R of PreS2. With this McAb, we developed a reversed
passive hemagglutination assay (RPHA) and ELISA for detection of PreS2 antigen.
The hemagglutination titers of monoclonal anti-PreS2 sensitized sheep red blood
cells were closely related with those of PHSA cells. The average hemagglutina-
tion titer of PreS2 antigen was higher in HBeAg positive sera than that in
HBeAg negative sera, though PreS2 antigen could be sometimes detected in HBeAg
negative and even in anti-HBe positive sera. In HBeAg positive sera, titers
of PreS2 antigen were correlated with those of HBsAg, but not paralleled with
those of HBeAg. It is suggested that PreS2 and HBeAg could not be substituted
for each other. The significance of PreS2 in relation to HBV DNA replication
and its diagnostic value still need further study.

Hepatitis B virus (HBV) envelope proteins are encoded by gene S, PreS2 and
PreS1. Recently, much attention has been paid to the PreS2 gene product
(PreS2 antigen). Researches have demonstrated that: a. On PreS2 antigen,
there is polymerized human serum albumin receptor (PHSA-R) which might help
HBV to gain access to hepatocytes by means of PHSA.[1,2] b. PreS2 antigen is
highly immunogenic, and could induce virus-neutrolizing antibody. So vaccine
containing PreS2 may probably become more protective.[3-5] c. It has been
reported that high content of PreS2 antigen exists on Dane and subviral
particles cooccurring with HBeAg, but scarcely on small spherical particles
co-existing with antiHBe.[1,6] So it is thought that PreS2 antigen in sera
might serve as a new marker for active replication of HBV DNA, and have
prognostic value. Monoclonal antiPreS1 and PreS2 have been obtained in some
laboratories.[7-9] In our Institute one monoclonal anti-PreS2 cell line has

been established. Hemagglutination assay and ELISA have been developed for the detection of PreS2 antigen with monoclonal anti-PreS2 (MC anti-PreS2). In this paper comparison is made between anti-PreS2 sensitized sheep red blood cells (SRBC) and PHSA cells. The correlations of PreS2 antigen with other markers of HBV infections are evaluated.

Material and Methods

Establishment of hybrid cell line. PHSA receptor activity positive HBV particles purified from PHSA-R positive sera of HBsAg carriers by affinity chromatography on PHSA-conjugated Seph-4B column and ultracentrifugation, were used in immunogen. BALB/c mice were first immunized with 100 µg of this immunogen emulsified in freund's complete adjuvant (FCA) intraperitoneally. At an interval of two months, 100 ug immunogen in saline was given intravenously as a boost injection. Three days later, spleen cells were prepared and hybridized with myeloma cells, sp2/0-Ag-14 (SP2/0), according to the conventional procedures.[10] Hybridoma supernatants were screened by PHSA hemagglutination inhibition assay for the ability to inhibit binding of PHSA sensitized SRBC with PHSA-R on HBV. Positive hybridoma were cloned and cultured in media and in mice.

Characterization of Mc anti-PreS2. Specificity of the monoclonal antibody (McAb) was characterized by EIA in Institute of Immunology CO., LTD. Tokyo, Japan (Table 1).

Table 1. Characterization of Monoclonal Antibody 2F2

Sample	System No	Sequential dilution of samples					
		1^0	3^1	3^2	3^3	3^4	3^5
2F2	(1)	39	33	39	39	33	19
	(2)	737	521	369	181	93	53
	(3)	39	32	31	33	19	11
	(4)	14	13	14	15	17	18
	(5)	1453	1489	1027	571	242	163
	(6)	9	10	9	9	11	10

$(A_{492} \times 10^3)$

Note: (1) PreS1: Polypeptide of PreS1 was distinctly expressed by E. coli.

   (2) PreS2: Polypeptide of PreS2 was also distinctly expressed by E. coli.

   (3) P-22.

   (4) Tubular particles + [sample (3^1-3^6 dil) + small particles] PreS1+PreS+S)

   (5) Small particles + [sample (3^1-3^6 dil) + small particles] (Pres2+S)   (S)

   (6) Small particles: PreS polypeptide poor-small particles were treated with Pronase E.

Ig class and subclass of McAb were characterized by micro-ouchterlony immunodiffusion method against sheep anti-mouse IgM, IgG, IgG1, 2a, 2b, 3 (Shanghai Biological Products Institute).

Application of Mc anti-PreS2. Reversed passive hemagglutination assay (RPHA) for PreS2 antigen determination. Mc-anti-PreS2 was purified from mouse acites by ion-exchange chromatography (DEAE-32). Equal volume of 1 percent formaldehyde was gradually added to 10 percent (v/v) SRBC fixed with glutaraldehyde and shaked gently at 37 C for 1 hour, and then washed three times with PbS. SRBC were resuspended at 10 percent in 0.1 M acetic acid buffer. Purified Mc-anti-preS2 was added to SRBC (100 μg/ml) and incubated at 37 C for 2 hours, then washed and resuspended at 1 percent in PBC (containing 1 percent normal rabbit serum and 0.5 percent normal horse serum) for use.

ELISA for PreS2 antigen determination. Polystyrene wells were coated with horse anti-HBs overnight at 4 C. Sera were added and incubated for 1.5 hours at 37 C, then horseradish peroxidase (HRP) conjugated Mc-anti-PreS2 was added. O-phenylene diamine was used as substrate. Absorbance was read at 490 by Miniread II (A Dynatech Product).

Serologic test. PHSA-R activity was determined by PHSA sensitized SRBC (Beijing Biochemical and Immunological Reagent Center). HBsAg was determined by RPHA cells (the Green Cross Corporation of Japan, Code 11032). HBeAg and anti-HBe were detected by RPHA cells and PHA cells (Green Cross Corporation of Japan. Code 12452 and 12422). The results of hemagglutination were expressed by the maximum twofold dilution of test samples (2) that induced obvious hemagglutination pattern. Titers equal to or higher than $2^{3.5}$ were considered positive.

Results

Establishment of hybrid cell line. After one successful fusion, supernatant of one among 75 wells tested could inhibit the binding of PHSA sensitized SRBC to PHSA-R or HBV. After cloning for three times and propagating in cultures and in mice for more than 6 months, the hybrid cell line (2E2) still keep stable and highly secreting ability.

Characterization of McAb. 2E2 McAb was found only to bind with PreS2 antigen, not with PreS1 and S antigen. It belongs to IgG subclass.

Preliminary application of Mc-anti-PreS2. Specificity and sensitivity of RPHA for PreS2 antigen determination. 124 HBsAg positive sera were detected, 107/124 samples showed hemagglutination titers equal to or higher than $2^{3.5}$. The positive results were further identified by the fact that all of the agglutinations could be blocked by Mc-anti-PreS2. All 117 HBsAg negative sera samples got negative results. Anti-PreS2 sensitized SRBC was compared with PHSA cells in the detection of PreS2 antigen. 80 HBsAg positive sera were tesed.[as printed] The hemagglutination titers of anti-PreS2 sensitized SRBC were about the same as that of PHSA cells. The results of the two were closely related (r=0.9369, P <0.0005, Fig 1).

Correlation between HBsAg and HBeAg. HBeAg was determined by hemagglutination assay in 92 HBsAg positive samples, 46 (50 percent) were HBeAg positive and 46 negative. In all of the 46 HBeAg positive area, PreS2 antigen could be detected by anti-PreS2 sensitized SRBC (100 percent) with titers ranging from 2^4 to 2^{12}, the average hemagglutination titer was 1: 286.6. In 46 HBeAg negative sera, 38 samples were PreS2 positive (82.6 percent) with titers ranging from $2^{3.5}$ to $2^{7.5}$, the average hemagglutination titer was 1:27.53 (Fig 2). The average hemagglutination titer of PreS2 antigen in HBeAg positive sera is higher than that in HBeAg negative sera (P<0.0005) while in HBeAg positive sera, titers or PreS2 were correlated only with those of HBsAg (Fig 3) but not with HBeAg titers (Fig 4).

Comparison of RPHA and ELISA in the detection of PreS2 antigen. In 81 HBsAg positive sera, PreS2 antigen could be detected in 68 by RPHA, and in 80 by ELISA. In 6 anti-HBe positive sera, PreS2 antigen could also be detected by both RPHA and ELISA. The P/N values were equal to or higher than 3.7.

Fig. 1. Comparison of hemagglutination titers of anti-preS2 sensitized SRBC with those of PHSA sensitized SRBC.

Discussion

Because of its ability to inhibit the binding of PHCA to PHSA-R on HBV, 2E2 Mc-anti-PreS2 may probably be antibody against PHSA-R on PreS2 antigen. It has been reported that the sera of some patients with hepatitis B or other liver diseases could get false positive results by PHSA cells method, owing to the presense of anti-PHSA and some other factors in their sera.[11,12]

Mc-anti-PreS2 sensitized SRBC has shown high specificity to PreS2 antigen, and could be used as a specific assay better than PHSA cells for PreS2 detection.
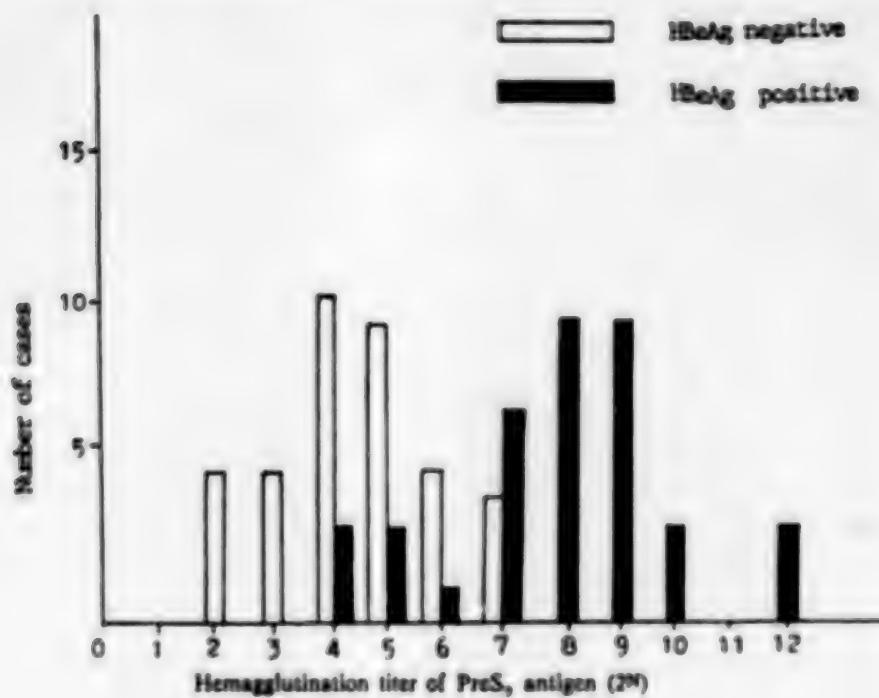
Fig. 2. Distribution of PreS2 antigen in HBeAg positive and HBeAg negative sera.
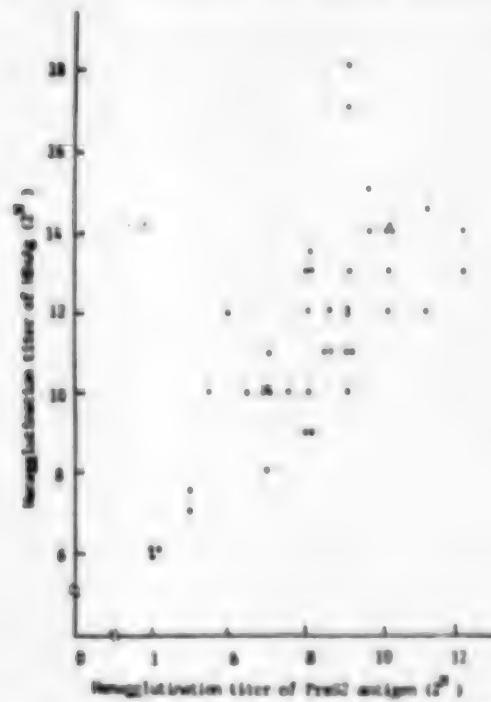
Fig. 3. Correction between hemagglutination titer of PreS2 antigen with those of HBeAg in HBeAg positive sera.

We found that the average hemagglutination titer of PreS2 antigen was higher in HBeAg positive sera than that in HBeAg negative sera. It is suggested that both PreS2 antigen and HBeAg be related to HBV DNA replication. However, PreS2 could not be used as a substitute of HBeAg or vice versa, because there is no close correlation between the titers of PreS2 and HBeAg.

Our findings showed that PreS2 antigens exist not only in most of HBeAg positive sera, but also in some anti-HBe positive sera. The results are same as previously reported.[13]

The high detecting rate of PreS2 antigen in HBsAg positive sera may be due to the increasing sensitivity of the test kit by using Mc-anti-PreS2. We think that only higher titers of PreS2 antigen may represent the active replication of HBV DNA.
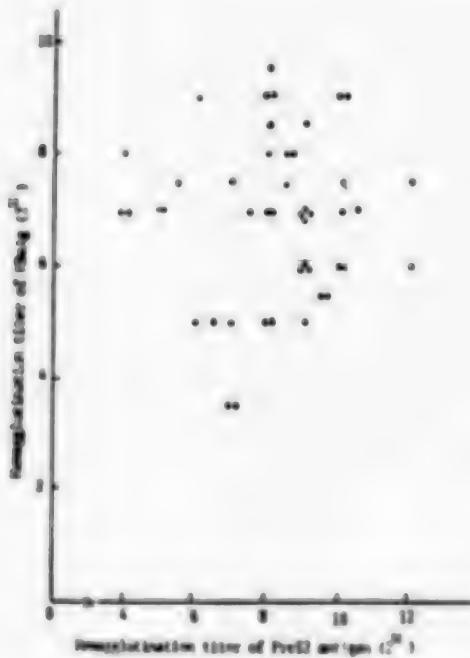
Fig. 4. Correlation between hemagglutination titers of PreS2 antigen with those of HBeAg in HBeAg positive sera.

Although the role of PreS2 antigen in HBV infection has not been clear yet, Mc-anti-PreS2 might be useful in further understanding its hepatotropism, immune patterns, and the relation to HBV replication as well as its diagnostic or prognostic value in patients with HBV infection.

References

1. Imai M, et al. A receptor for polymerized human and chimpanzee albumins on hepatitis B virus particles co-occurring with HBeAg. Gastroenterology 1979; 76:242.

2. Machida A, et al. A polypeptide containing 55 amino acid residues coded by the Pre-S region of HBV deoxyribonucleic acid bears the receptor for polymerized human as well as chimpanzee albumins. Gastroenterology 1984; 86:910.

3. Neurath AR, et al. Hepatitis B virus contains pre-S gene encoded domains. Nature 1985; 315:154.

4 Yukio Itoh, et al. A synthetic peptide vaccine involving the product of the pre-S(2) region of hepatitis B virus DNA: Protective efficacy in chimpanzees. Proc Natl Acad Sci USA 1986; 83:9174.

5. Neurath AR, et al. Antibodies to a synthetic peptide from the PreS2 120-145 region of the hepatitis B virus envelope are virus-neutralizing. Vaccine 1986; 4:35.

6. Kazuaki Takahashi, et al. Polypeptides coded for by the region pre-S and gene S of hepatitis B virus DNA with the receptor for polymerized human serum albumin: expression on hepatitis B particles produced in the HBeAg or anti-HBe phase of hepatitis B virus infection. J Immunol 1986; 136:3467.

7. Heermann KH, et al. Large surface protein of hepatitis B virus containing the Pre-S sequence. J Virol 1984; 52:396.

8. Hiroaki Okamoto, et al. Hemagglutination assay of polypeptide coded by the Pre-S region of hepatitis B virus DNA with monoclonal antibody: correlation of Pre-S polypeptide with the receptor for polymerized human serum albumin in serum containing hepatitis B antigen. J Immunol 1985; 134:1213.

9. Neurath AR, et al. Characterization of monoclonal antibodies specific for the Pre-S2 region of the hepatitis B virus envelope protein. Mol Immunol 1986; 23:991.

10. Galfre G, Milstein C. Preparation of monoclonal antibodies: strategies and procedures. In: Langone JJ, Vunakis HV. Methods in enzymology. USA: Academic press, 1981; 73(part B): 3-46.

11. Thung SN, et al. HBsAg-associated albumin receptor and anti-albumin antibodies in sera of patient with liver disease. Gastroenterology 1981; 80:260.

12. Sansonno DE, et al. Serum binding activity for human albumin polymers in acute and chronic virus hepatitis. Hepatogastroenterology 1985; 32:227.

13. Hu PS, et al. Quantitative studies of the hepatitis B viral pre-S proteins: lack of correlation with the HBeAg status. J Virol Meth 1987; 16:97.

/08309

Briefs

Donghai 32-Bit Microcomputer--Shanghai Electronic Computer Plant, a major affiliate of the Chang Jiang Computer Group, has formally introduced the Donghai 0540A high-performance 32-bit microcomputer system, the successor to the plant's 0520 and 0530 series microcomputers. Using Intel's 80386 CPU, the Donghai 0540A incorporates such advanced technologies as multi-layer pc boards, gate arrays, and high-capacity peripheral storage equipment. Upward compatible with IBM-PC/XT and AT software, the 0540A provides PC users with an ideal environment for improved digital information processing and has a better cost performance ratio. [Summary] [40080018c Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 30, 10 Aug 88 p 1]

Minisupercomputer Given Export Permit--Officials of the U.S. corporations Hamilton/Brighton and [its affiliate] Gould Limited held a joint press conference in Beijing recently to announce the U.S. government's permission to export Gould's NPL minisupercomputer to the PRC. The spokesmen pointed out that, while exports of vector processing minisupercomputers are not permitted under recently relaxed COCOM restrictions, the approval was granted on condition that the vectorized elements (vectorized precompiler software and appropriate microcodes) be removed. [Summary] [40080018d Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 30, 10 Aug 88 p 2]

Provisional Antipollution Regulations

40101023 Beijing XINHUA Domestic Service in Chinese 1033 GMT 10 Aug 88

[Text] Beijing, 10 Aug (XINHUA)—Provisional Regulations Governing Compensated Use of Special Funds for Treating Sources of Pollution

Article 1. These regulations are formulated in order to do a good job in controlling pollution sources, rationally using funds for such purposes and improving social results [she hui xiao yi 4357 2585 2400 4135].

Article 2. The state sets up the special funds for treating sources of pollution (hereafter referred to as "funds").

The funds will be established by the environmental protection department of a province, (autonomous region or municipality under the direct control of the central government), a city, or a county. The funds are administered at different levels with a separate system. They may be used in the form of a loan.

Money for projects will be issued through banks as loans to the users.

Article 3. The funds will come from fees charged on enterprises that discharge more pollutants than the state standards permit on the basis of the "Interim Procedures on Collecting Fees to Combat Pollution" issued by the State Council and used to help key pollution control units treat pollution sources. The percentage of money which may be drawn is between 20 and 30 percent of the total amount of fees with the exact amount to be determined by the people's government of a province, autonomous region or by the people's government of a province, autonomous region or municipality under the direct control of the central government.

Localities where all or most of the funds can be used in the form of a loan may continue to permit the use of such funds as usual.

The unused portion of the fees charged in the past on enterprises that discharge more pollutants than the state standards permit should become a part of the funds.

73

Interest for the loans, surcharges for overdue payments and fines for failing to pay interest should be put into the funds except for the bank service charges as specified by the state.

Article 4. Only those enterprises that pay fees for the control of extra pollutants they discharge are eligible for theloans from the funds.

Article 5. Money should be used for the following projects:

(1) key projects for the control of pollution sources;

(2) projects for the comprehensive use of waste water, waste gas, or industrial wastes;

(3) pilot projects for the control of pollution sources;

(4) pollution control facilities for those enterprises that merge with other enterprises, manufacture other products or move to another location in order to solve the problems in pollution.

Article 6. Within the scope of prospective borrowers and the use of funds, enterprises that meet the following requirements may submit application to the environmental protection department for the use of the funds:

(1) enterprises that pay fees according to regulation for the extra pollutants they discharge;

(2) enterprises whose projects are regarded as actually feasible by a study of its feasibility;

(3) enterprises that raise a part of the funds by themselves;

(4) enterprises that have the ability to repay loans.

Article 7. Priority for loans will be given to the following applicants who meet the requirements listed in Article 6 as well as one of the following conditions:

(1) enterprises that are given a time limit to control their pollutants;

(2) serious polluters who need to be tackled badly;

(3) polluters who can raise more than 60 percent of the funds needed.

Article 8. The funds are placed under the unified management of the environmental protection departments, and loan plans should be made known to the lower levels with the coordination of thefinancial departments. On the basis of the loan plans, the financial departments will transfer money from the fees for the control of extra pollutants turned over to the state treasury every quarter to the special account for pollution control funds set up by the environmental protection departments in the bank.

Article 9. Enterprises that apply for loans must complete the "application form for special loan to control pollution sources" and submit it together with a feasibility report and other documents to the department in charge of the enterprise for examination. The application will then be forwarded to the environmental protection department for examination and approval pending the bank's verification of the prospective borrower's ability to repay the loan.

The department in charge of the enterprises may also submit application to the environmental protection department for the use of funds after examining the loan applications from its own enterprises and on the basis of the actual situation in its trade; and make arrangements for the use of loans approved by the environmental protection department for the various enterprises.

Article 10. After the loan application is approved, the enterprise that applies for the loan and the bank should sign an agreement based on which the bank grants the loan on time and in full amount.

The bank will supervise the use of loans according to regulation, ensure the repayment of the principal and the payment of interest on loans, and submit quarterly reports to the financial and environmental protection departments on disbursement and repayment of the loans.

Article 11. Loans must be repaid within 3 years. The monthly rate of interest is .24 percent for one year, .27 percent for two years and .30 percent for three years. The interest is to be compounded quarterly.

Article 12. Before a construction project officially goes into operation in production, the enterprise that uses the loan must submit a "report on the completion of the project to control pollution sources for checking and acceptance" to the environmental protection department responsible for examining and approving the loan. After checking and accepting the completed project, the environmental protection department may exempt the enterprise from repaying a part of the loan. In general, the amount of loan exempted should not exceed the total amount of fees which the enterprise has contributed to the funds in the past years minus the past exemptions, if any.

Article 13. Except for the exemption mentioned in Article 12, the principal may be repaid and interest on the loan paid from the following funds:

(1) funds at the disposal of the enterprise; funds of state-run enterprises for equipment renewal and innovation; development funds of state-run enterprises for production; accumulation funds of collectively-owned enterprises; funds of cooperative institutions; and funds retained for their own use by enterprises for equipment renewal and innovation;

(2) portion of profits made by the comprehensive utilization of waste water, waste gas and industrial wastes and retained for their own use by enterprises;

(3) funds appropriated by the department at the higher level for pollution control.

With the approval of the local financial department, the enterprise with a fairly large loan that actually encounters difficulty in repaying it with the aforementioned funds may make yearly repayments on the basis of the amount of fees it paid for the control of the extra pollutants it discharged in the year prior to the completion of the project for which the loan is being used. However, the period for total loan repayment must not exceed 3 years.

Article 14. An enterprise requiring amendment to or cancellation of a loan agreement should notify the bank and report to the original environmental protection department that has examined and approved the loan for approval.

Article 15. An enterprise that has obtained a loan should repay the loan and settle accounts of both principal and interest on schedule. In case it fails to do so, the bank has the right to deduct and take back the loan within a specified time, charge interest by the highest monthly rate of 0.003 percent of the loan, and impose a penalty of 0.0015 percent monthly interest rate.

Article 16. If an enterprise that has obtained a loan misappropriates the loan, the bank has the right to take back the loan in part or in whole. For the misappropriated portion, an interest rate of 0.003 percent, the highest monthly rate of the loan, will be charged; meanwhile, a penalty of 0.006 percent monthly interest rate will be imposed. Those who are directly responsible for misappropriation and the enterprise's responsible persons will be given administrative punishment by their respective unit and the higher responsible authorities. If their act constitutes a crime, the judicial organs will investigate and affix responsibility in accordance with the law.

Article 17. If the personnel of the environmental protection department are found to engage in dereliction of duty and malpractices for the purpose of benefiting their relatives and friends, they will be given administrative punishment by their respective units and the higher responsible authorities. If their act constitutes a crime, the judicial organs will investigate and affix responsibility in accordance with the law.

Article 18. The people's government of every province, autonomous region, and municipality may draw up measures for implementation on the basis of these regulations.

Article 19. These regulations will go into effect beginning on 1 September 1988.

/9604

Practical Measures Needed in Integration of Electromechanical Industry

40080007a Beijing ZHONGGUO JIXIE BAO in Chinese 18 Aug 88 p 1

[Article by Li Peisen [2621 1014 2773]: "Experts Recommend Practical Measures for Integrating Electromechanical Industry"]

[Text] The Ministry of Machinery & Electronics Industry said that experts have recently studied the integration of the electromechanical industry in China. They believe that China should vigorously develop integrated electromechanical products and should stress the industrialization of numerically controlled (N.C.) machines, new generation control systems and electric and electronic products.

Electromechanical integration is the combination of mechanical, microelectronics and computer technologies. It is an area to which great efforts are devoted by many industrialized nations in the world. Electromechanical integration as a part of high-tech has become a prominent trend in the mechanical technology and product development in the world.

It is known that industrially advanced nations in the world are paying great attention to the development of N.C. machine tools. It has become the focus for the revolution of the mechanical industry and has drawn a high level of effort. In 1987, 70 percent of the machine tools produced in Japan were numerically controlled. In the Soviet Union the percentage was 46 but in China it was only 6.15 percent. All industrially advanced countries have a strong industry of N.C. machines. For example, the Fanuc Machine Tool Company in Japan produces more than 45,000 N.C. systems and 200,000 servomotors. In China the research into and production of N.C. machine tools and systems began in 1958. Today, only the Beijing Institute of Machine Tools can produce 400 systems per year, with 30 percent of the components made domestically. Other units are still in the stage of small batch production or prototype testing. The production of N.C. devices is yet to form an industry in China. According to the 1987 data of the State Statistics Bureau, China has an annual output of 2,600 N.C. machines (including 1,500 low grade cutting tools) at a value of 150 million yuan.

Since the mid-1970's there have been rapid developments in control, microprocessor, image display and digital communication technologies. Overseas companies specialized in control devices have produced a series of new

industrial control systems based on the high-tech results. Applications have been generalized to large thermal electric power generators, large steel industries and machine making enterprises. The development of new control systems has just begun in China. Workers directly involved with research and production of control devices are only about 3,000 and only 12 percent of them are technical workers, which is a far cry from a mature high-tech enterprise.

Electric and electronic technology, especially AC variable frequency speed control techniques, has enjoyed robust growth in industrially advanced countries. Japan and West European countries have developed a number of variable frequency governors with performances and cost approaching that of DC governors. China was quite successful in developing first generation non-interruptible semiconductor devices and acquired mass production capability. However, since the 1970's other countries have developed second generation power semiconductor devices including hybrid devices and intelligent ICs and have promptly applied them to various AC switching, governing and servo devices to improve performance and capabilities. As far as second generation electrical and electronic technology in China, only the Beijing Chunshu Rectifier Plant has imported GTO and GTR manufacturing capability and facilities from the British Marconi Company and initial production will not begin until 1990. The electric and electronic industry is one of the supporting industries of China's high-tech enterprise. At today's level, China lags behind the Western countries by at least 15 to 20 years.

In order to ensure rapid and steady progress of China's high-tech electro-mechanical integration, the experts recommended that the Ministry of Machinery and Electronics Industry should strengthen its leadership over this high-tech field, formulate development targets, organize interregional major projects and coordinate joint efforts. The State should have policies that encourage and reward units and individuals engaged in the development and production of high-tech products. The experts stressed the importance of basic technology and components because they have become the bottleneck in electromechanical integration. Without the basic technology and the basic components, high-tech industry cannot take root. The experts also recommended centralized usage of the funding resources and the establishment of a number of skeleton enterprises and research centers for electromechanical integration.

9698/08309

Beijing Promoting Microelectronics Technology

40080007b Beijing ZHONGGUO JIXIE BAO in Chinese 20 Aug 88 p 1

[Article by Li Peisen: "Beijing Extending Applied Microelectronics Technology to All Parts"]

[Text] Microelectronics technology has been applied to all 16 bureaus (general companies) of the Beijing industrial system. In the last 3 years digital display has been applied to more than 1,500 machine tools, circuit boards and PC boards have been used in 400 machines, microelectronics technologies have been applied to 230 industrial furnaces, and microcomputers have improved 1,200 mechanical facilities and production lines. The economic benefits of these improvements have reached 75 million yuan.

A unique feature of Beijing's microelectronics industry is that they not only work on the improvement of machine tools and furnaces, they also apply the technologies to light industries, textile, chemical and metallurgical industries. Microcomputers are not only used in monitoring and controlling the production process but also in management functions such as cost computation and market forecast. For example, microcomputers are used by the Beijing Refrigerator Plant and the Beijing Washer Plant in testing the performance of the refrigerators and washers and controlling the quality. The Beijing No 2 Chemical Plant used microcomputers and PCs in the control of ten 30-cubic-meter polymerization chambers and saved 210,000 cubic meters of compressed air and 23,000 kilowatt hours of electricity. As a result, they increased the annual output of polyvinyl chloride by 750 tons and created an economic benefit of 375,000 yuan. At the Capitol Steel Works, computerized control was applied to major production steps including sintering, iron and steel making, rolling, and wire making and 31 industrial ovens and furnaces. The automation has reached the international standards of the 1980s.

Beijing also actively applied microcomputers to the improvement of old products and development of new products. Based on preliminary statistics, more than 200 new products have been developed with the aid of microcomputers. Products reaching international quality standards include the model MD-TA61 electronic organ manufactured by Beijing No 10 Semiconductor Plant, the five-meter numerically controlled planer type milling machine made by Beijing No 1 Machine Tool Plant, the four-color offset printing press made by Beijing People's Machinery General Plant, and the atomic absorption spectrophotometer made by the Beijing No ' ical Instrument Plant and the Beijing Analytical Instrument Plant.

9698/08309

Earthbound Glove Can Pour Milk in Space

40100003 Beijing CHINA DAILY in English 12 Sep 88 p 1

[Text] New York (Xinhua)--Two visiting Chinese scientists have developed an advanced system to operate a robot hand that could be used in space and deep sea research as well as in daily life.

The system, developed by Professor Hong Jiawei of the Beijing Institute of Computer Science and Dr Tan Xiaonan of the Chinese Academy of Sciences, has received much attention here.

The system uses a VPL dataglove--a cloth glove with optic fibres attached to the back and palm of a wearer and passing over his finger joints. With the glove, the wearer can operate the robot hand by means of telecommunications.

According to Hong and Tan, although ordinary optic fibres are capable of transmitting light when they are bent, those used in a dataglove are treated at the sites where fingers flex so that light escapes when a finger is crooked, or when the wearer moves his thumb toward his forefinger. Phototransistors convert the light into an electric signal which is then digitized by a computer.

Coupled with a sensor mounted on the back of the dataglove, the position and orientation of the robot hand in space as well as 14 finger joint angles can be measured in real time.

Hong and Tan, both now visiting researchers at the Robotics Research Laboratory of the Courant Institute at New York University, showed a videotape of the performance of the robot hand.

Using the VPL dataglove, Hong teleoperated the robot hand to pick up a milk carton and pour the milk into a cup. Then the hand picked up a nut and screwed it onto a bolt.

"The goal of our research is to develop a robot hand that can perform approximately as well as a human hand," Hong said.

The advantage of the new system, they said, is that it is multi-functioning rather than single functioning, as is the commonly used robot hand. When it is fully developed, the robot hand can be flexible enough to do all kinds of complicated work ranging from daily life to scientific research.

Since the technique of electromagnetic induction is used in the dataglove, the operator who wears it can, for instance, operate from the earth a robot hand installed in a satellite in space.

When the system, now still in the process of further improvement, is fully developed by adding the techniques of position and torque feedback from the robot hand in the coming years, the system capability will be greatly increased.

"We plan to use the system to record and play back motions, in order to understand how to build libraries of simple manipulations from which more complicated and useful gestures car be built," they said.

09986

Latest Developments in CNC, NC Machine Tools, Flexible Manufacturing Systems

New Machine Produced Through Joint Effort

40080016 Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese
30 Jul 88 p 1

[Article by Yun Hua [0061 5478]: "The Birth of China's First Numerically
Controlled Punch and Nibbler Press"]

[Text] China's first numerically controlled punch and nibbler press, the TCQ2025,
passed acceptance check by experts from China and West Germany at the Machine
Tool Plant No 2 in Qiqihar recently. The model TCQ2025 numerically controlled
punch and nibbler press was manufactured by the Qiqihar Machine Tool Plant No 2
with technology imported from the Trumf [phonetic] Company of West Germany.
It makes use of interactive programming, and uses easily configured die sets
to punch or nibble at metal plates. It can do one-shot production of parts with
nearly any needed configuration. It is estimated that China's electronics,
electrical appliance, and machinery industries will require more than 100 units,
and that after this numerically controlled press has gone into batch production
it will result in a savings to the state of 15 million U.S. dollars in foreign
exchange.

New Machine Plant Extension in Ningxia

40080016 Beijing ZHONGGUO JIXIE BAO in Chinese 30 Jul 88 p 3

[Article by He Manzi [0149 2581 1311]: "The Ningxia Great Wall Machine Tool
Plant--A Shining New Star Among Machine Tools on the Northwest Plain"]

[Text] In 1965 the Great Wall Machine Tool Plant moved inland from the city
of Dalian to the city of Yinchuan in Ningxia. After several expansions, it
has developed into the largest production base in China for the hydraulic
repetition lathe, and into an important development and production plant for
numerically controlled machine tools.

Since its founding 23 years ago, the staff at this plant has joined to foster
and cultivate the "Great Wall spirit," which is united for innovation,
strictly realistic, dedicated to culture, and striving to be the best. They
have worked in difficult conditions, emerged successfully from ardent
competition, and have continued to develop and advance together with a
growing reputation and name recognition from their park-like modern enterprise

in the wilderness beneath the mountains at Helan. The factory is 300,000 square
meters in area, has workshop and construction areas totaling more than 30,000
square meters, and employs more than 2,000 people, among whom 20 percent are
engineers and technical personnel. They own nearly 400 units of basic production
equipment, which includes 77 items of large-scale precision equipment, some of
which was imported, and rather complete processing capacity and the means for
measurement and testing. In addition to the series production of hydraulic
repetition lathes and numerically controlled machine tools, they also manufacture
lathe processing automation lines, combination lathes, special purpose lathes,
and ordinary lathes. Their leading products have attained an advanced level
equivalent to the international standard of the late 1970s or early 1980s,
all have thoroughly incorporated international standards or national equivalent
standards, and all are "outstanding name brand products" as judged by the
autonomous region and by ministries or higher agencies. Among these products,
the CE7112 repetition lathe has twice won the national silver medal for product
quality, and the CK7815 numerically controlled lathe won the national silver
medal for quality in 1986. This plant has achieved a distinct reputation within
international markets, and its products are sold throughout 28 provinces,
municipalities, and autonomous regions, as well as in nearly 40 countries and
regions.

The party policies of restructuring liberalization have brought unlimited life
and vitality to the Great Wall Machine Tool Plant. In the two years 1986 and
1987 alone, they received over 60 commendations from the State Council and
from various State Council ministry commissions, the autonomous region, the city
of Yinchuan, and from the government. They have fully advocated the 18 methods
for modern management as recommended by the State Economic Commission, and at
present all have been either brought into the system or generally disseminated
and applied. Among these, ten items involving microcomputer management and
full-scale quality control have brought optimistic results, and they rank
among the leaders in similar industries throughout the region and the country
at large. This plant has implemented a modern management system reflecting the
character of the plant, economic results have seen a significant increase, each
economic and technical index has made an annual jump over each of the last four
years, and the gross industrial output values, real profits, and tax contributions
have grown at an average annual rate of 15.8, 50.8, and 38.5 percent, respectively.

This plant is one of those responsible for the primary science and technology
projects in the state's Seventh Fifth-Year Plan. This plant formulated the
overall operations policy of "science and technology will lead the way, we will
improve production operations, our products will be foremost among domestic
products, and we will catch up with world standards," and has determined the
overall planning and new product development for the growth of science and
technology during the Seventh Five-Year Plan, as well as growth planning. They
have established and consummated a new products development system, and
solidified functional structures in new product design, techniques, scientific
and technical information, product standardization, and trial production
workshops. They have built the Ningxia Institute for Automated Milling, which
has 76 scientists who are involved with automated milling tools, high precision
numerically controlled lathes, and high precision combination lathes, as

83

well as research and development efforts for flexible machining units, flexible machining systems, and industrial robots. They have achieved preliminary results from this work. This plant has emphasized technology transformation and technology advances, having imported equipment such as machining centers and precision guided grinders over the past few years. They have recently built a 900-square-meter constant temperature chamber and precision workshop, and have entered into technology exchanges and cooperation with foreign plants in Japan, the United States, and Italy. In recent years they have come up with more than 70 new products and specialized machine tools, among which are eight different kinds of numerically controlled lathes in four series. Eight products have been awarded prizes for new product development at the ministry level or higher, and 19 new products have filled national voids. This plant has developed the model CSK20 numerically controlled lathe, which was the first to pass national level evaluations; this was the first plant in the country to receive a national level prize for quality, with its model CK7815 numerically controlled lathe; and the powerful model CK7840 numerically controlled lathe is the highest powered, fastest revolving, and highest precision machine of its type allowed by regulations. In 1988 the FMC1 flexible unit and CKS7832 four-axis numerically controlled lathe won the outstanding design award and the Spring Swallow prize, respectively, at the first China Machine Tool Exhibition. Products from the Great Wall Machine Tool Plant have often represented China at large-scale industrial exhibitions in Paris, Milan, Osaka, Hannover, and Moscow, and they have made a contribution to expanding China's political influence and increasing the export of electromechanical products.

New World-Class Chinese Planer

40080016 Beijing ZHONGGUO JIXIE BAO in Chinese 9 Aug 88 p 4

[Article: "The First World-Class Planning Machining Center in China Passes National-Level Evaluations in Beijing"]

[Text] The first Chinese planer machining center, having the highest contemporary international standards and engaged in cooperative manufacture between the Beijing First Machine Tool Plant and the West German (Waldrich Coburg) Company, recently passed state-level evaluations.

Experts and representatives from 26 units of the Ministry of the Machine-Building and Electronics Industry and from Qinghua University reviewed the relevant technical documents, watched a demonstration of an on-site cutter, and did spot checks of five points for geometric precision. They unanimously agreed that the precision, performance, and level of technology for this machine tool were at the highest world standard. This tool comes with 60 cutters, which allow for the processes of milling, boring, drilling, and reaming on large-scale components. It is completely numerically controlled, doing automated processing, blade switching, and testing as it is programmed to do.

New Hobbing Machine

40080016 Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese 10 Aug 88 p 4

[Article by Lei Wenfu [7191 2429 1381]: "Dual-Axis Numerically Controlled Hobbing Machine Is Efficient and Has Many Features']

[Text] Institute 7306 of the Ministry of Aeronautics and Astronautics Industry and the Chongqing Machine Tool Plant have joined to successfully develop the model YK3132 numerically controlled hobbing machine. It utilizes the Japanese Fujitsu 3M-A microprocessor control system. The main axis employs a broad amplitude DC motor, which results in stepless governance, and through the DC servo pulse coder and detector function components constitutes a CNC closed-loop system, which expands the usage characteristics of the tool. It also uses a programmable controller for insertion and filling functions on the X and Z axes.

This machine can store 63 component programs. It includes the following functions: automatic or manual continuation, hand feeding (calculated accuracy of plus or minus 0.001 mm), space compensation, screw-pitch error compensation, blade radius compensation, two numeric formats, software and hardware protection for over-limit, and a CRT programmed execution automatic monitoring facility. One may return to the reference point either manually or automatically, which improves the precision of repeated positioning and reduces time spent aligning the blades. Cutting speed can be higher than 200 meters per minute.

Machine Tool Manufacturing Plant To Be Built in Shanghai

40080016 Beijing ZHONGGUO JIXIE BAO in Chinese 3 Sep 88 p 1

[Article by Lu Bo [7120 3134]: "The Shanghai Machine Tool Plant Will Build a Machine Tool Manufacturing Enterprise of Advanced World Standards"]

[Text] On 29 July the Shanghai Machine Tool Plant used a loan from the World Bank to open the curtain on technology transformation of the plant as construction began on the Joint Plant Workshop No 6. It has been said that completion of the Shanghai Machine Tool Plant technology transformation will create a machine tool manufacturing enterprise that is at advanced world standards.

During the 7th Five-Year Plan, the Shanghai Machine Tool Plant has used the World Bank loan to undertake technology transformation projects with a total value of 186 million RMB, equivalent to more than the value of the fixed assets of the plant at present. This item has been included among major national technology transformation projects, and is also one of 14 key projects of the Shanghai Municipality mass campaign. Construction of the Joint Plant Workshop No 6 is a major component of the foreign investment for technology transformation by the Shanghai plant.

Air-conditioned space in the workshop will be 10,400 square meters, a constant temperature dust-free area of 430 square meters, and will be finished at the end of next year. This will be the largest and best workshop for the machine tool industry in China.

Using its foreign capital for technology transformation will allow product, technique, and management standards at the Shanghai Machine Tool Plant to equal those of similar industries in industrially developed countries during the late 1970s or early 1980s. As far as technique is concerned, this plant

uses advanced world manufacturing technologies, the foundry uses advanced resin-bonded sand molding and matched plate casting assembly lines; the workshop for small-to-medium parts is composed of flexible production units, which can process individually through a computer, or they can be combined linearly, and they can even carry out manufacturing without people; and the assembly shop allows dust-free assembly. In the field of management, everything is done with computers. As far as products are concerned, primary development and manufacturing is of precision efficient numerically controlled grinders and of high-precision large-scale measurement instrumentation. During the period of the 7th Five-Year Plan, 52 new products will completely attain the level of international standards of the late 1970s and early 1980s.

12586

Calculation of Radiant Sensitivity for Space-Borne Multispectral Scanner

[Article by Han Xinzhi [7281 1800 1807]]

[Text] I. Introduction

The geometric and optical characteristics of ground target emission are the basic signatures used for distinguishing and classifying ground targets.

In the case of space-borne optical sensors, it is difficult to distinguish the geometric characteristics of ground targets because they are generally in an orbit several hundred kilometers above the earth; consequently, optical characteristics have become the primary basis for target discrimination. A key problem of space-borne multispectral sensors is the ability to measure spectral irradiance and its measurement accuracy. In practice, the design of multispectral instruments generally involves trade-off considerations centered around the issues of measuring spectral irradiance and its measurement accuracy. An in-depth study of this problem not only has theoretical value but is also of practical interest.

II. Noise Equivalent Radiance

The noise equivalent radiance (NER) of a scanner system is defined as the change in target radiance which produces a signal equivalent to the system noise. In other words, NER is the radiance which results in a signal-to-noise ratio (SNR) of 1, i.e.,

$$NER = \frac{\Delta N_s}{(V_s/V_n)} \tag{1}$$

Where ΔN_s is the change in target radiance; V_s is the signal voltage proportional to the change in target radiance; and V_n is the noise voltage. NER is the smallest detectable radiance; it is also defined as the discrimination capability of the system.

For a scanning radiometer or a scanner, NER is related to the noise equivalent power of the detector as follows:

$$NER = \frac{NEP(A_d, \Delta f_n) \cdot \gamma}{A_0 T_0 \Omega} \tag{2}$$

where NEP $(A_d, \Delta f_n)$ (W) is the noise equivalent power of the detector; $A_d(cm^2)$ is the area of the detector; Δf_n(Hz) is the noise equivalent bandwidth of the radiometer; γ is the circuit degradation factor; $A_0(cm^2)$ is the effective aperture area, T_0 is the effective optical "transmittance" factor of the radiometer which includes the effect of all the reflecting mirrors, lenses, and filters; Ω(sr) is the solid angle of the instantaneous field of view of the radiometer.

The area of the detector can be expressed in terms of parameters of the optical system, i.e.,

$$A_d = (D_0 \cdot F \cdot \alpha)^2 \tag{3}$$

where D_0 is the aperture diameter (cm); F is the effective F number of the optical system; α is the instantaneous angular field of view (radians).

By substituting equation (3) and the expression

$$D^* = \frac{(A_d \cdot \Delta f_n)^{1/2}}{NEP} \tag{4}$$

into equation (2), one obtains:

$$NER = \frac{4 F (\Delta f_n)^{1/2}}{\pi D_0 D^* T_0 \Omega^{1/2}} \tag{5}$$

When the system scans over a large area with a square instantaneous field of view, and a low-pass filter is used in the signal processing unit of the detector, we choose:

$$\Delta f_n = \frac{3}{4 \tau_d} \approx \frac{\pi}{4 \tau_d} \tag{6}$$

to maximize the thermal sensitivity of the system. We can also choose the noise equivalent bandwidth to be equal to the signal bandwidth, i.e.,

$$\Delta f_n = \Delta f_s = \frac{1}{2 \tau_d} \tag{7}$$

This corresponds to applying high-frequency compensation to the circuit to produce a rectangular frequency spectrum.

Now we shall derive an expression for the dwell time of the detector ensuring the scanning process using an oscillating mirror.

The condition for the satellite subpoint to achieve nonrepetitious and complete coverage is:

$$V = \alpha H n \nu a,$$ (8)

where V is the subpoint velocity; α is the instantaneous angular field of view along the direction of motion; n is the number of parallel-scanning detectors; ν is the oscillating frequency of the scanning mirror; and a is the number of effective scans within one cycle of mirror motion. Therefore, the scan period is

$$T = \frac{1}{\nu} = \frac{\alpha n a}{V/H},$$ (9)

where V/H is the velocity to height ratio of the satellite subpoint.

Let θ be the effective total field of view in the scan direction, then the scan angular velocity of the oscillating mirror is

$$\omega = \frac{m\theta}{\eta T},$$ (10)

where η is the scan efficiency of the scanning mirror.

$$\eta = \frac{T_e}{T} = \frac{m\theta}{2\theta_{max}},$$ (11)

where T_e is the effective scan time for data collection; θ_{max} is the angular field of view corresponding to the mirror scan angle, which includes the linear field of view angle for data collection and the nonlinear portion to allow for mirror motion between the two extreme positions.

From the definition of detector dwell time, and making use of equations (9), (10), and (11), one obtains:

$$\tau_e = \frac{\alpha}{\omega} = \frac{\alpha n \eta}{\theta(V/H)}.$$ (12)

Substituting equation (12) into equation (6) gives:

$$\Delta f_e = \frac{\pi}{4\tau_e} = \frac{\pi \theta(V/H)}{4\alpha n \eta}.$$ (13)

Then, by substituting equation (13) into equation (5), one finally obtains:

$$NER = \frac{2\gamma F}{D_o D^* T_e \Omega} \sqrt{\frac{\theta(V/H)}{\pi n \eta}}.$$ (14)

In the case where the target completely fills the field of view,

$$E = N\Omega$$ (15)

By substituting equation (14) into equation (15), we obtain another expression for measuring radiant sensitivity, i.e., the noise equivalent irradiance:

$$NEI - \frac{4\gamma F}{D_0 D^* T_0} \cdot \sqrt{\frac{\theta(V/H)}{\pi n \eta}} \qquad (16)$$

III. Noise Equivalent Temperature Difference and Signal to Noise Ratio

The noise equivalent temperature difference is a parameter for measuring radiant sensitivity in the thermal band; it is related to the noise equivalent radiance as follows:

$$NE\Delta T - NER \left[\frac{dN(\Delta\lambda)}{dT} \right]_{T_0}^{-1} ; \qquad (17)$$

where NEΔT is the noise equivalent temperature difference of a radiometer operating in the optical band $\Delta\lambda$ and observing a black-body target whose temperature is T_0; $\left[\frac{dN(\Delta\lambda)}{dT} \right]_{T_0}$ is the measured thermal derivative of the target scene within the optical band, where the scene temperature is T_0.

The S/N output of the radiometer can be expressed as:

$$S/N - N(\Delta\lambda)_{T_0} [NER]^{-1} ; \qquad (18)$$

where $N(\Delta\lambda)_{T_0}$ is the effective radiance of the band when the target temperature is T_0. The data $\left[\frac{dN(\Delta\lambda)}{dT} \right]_{T_0}$ and $N(\Delta\lambda)_{T_0}$ can be obtained from tables of black-body radiation.

In the case of a radiometer which measures the temperature distribution of a ground target, its frequency response and noise equivalent temperature can also be regarded as sensitivity parameters. Let the output signal voltage of the radiometer be V_s, then its response is

$$R - \frac{V_s}{E A_0 T_0} \qquad (19)$$

The relationship between the noise equivalent temperature and other radiant sensitivity parameters can be represented by the curves shown in Figure 1.

The system noise equivalent voltage

$$V_s - \frac{(A_e \cdot \Delta f_s)^{1/2}}{D^*} R \qquad (20)$$

is a constant and is shown as a horizontal line in Figure 1.
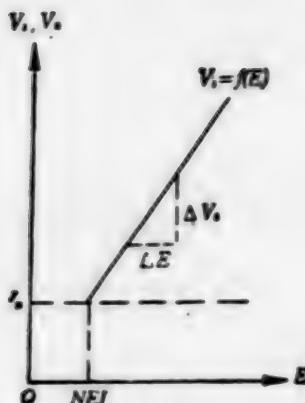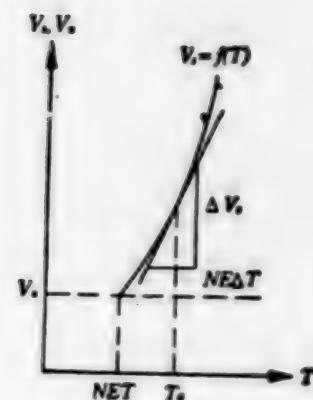
Figure 1. Meaning and Relationship Between Radiant
Sensitivity Parameters

IV. Difference in Noise Equivalent Reflectance and Signal to Noise Ratio

The difference in noise equivalent reflectance is a radiant sensitivity parameter used in the reflecting band (primarily in the visible and infrared bands). It can be expressed in the form:

$$NE\Delta\rho = \frac{\Delta\rho}{(V_s/V_n)} \quad (21)$$

where $\Delta\rho$ is the change in target reflectance required to produce a signal voltage V_s.

Therefore, $NE\Delta\rho$ is the system discrimination capability expressed in terms of the reflectance; it is also the smallest detectable change. Its relationship to NER is as follows:

$$NE\Delta\rho = \frac{\pi NER}{H_t} \quad (22)$$

where the total target irradiance H_t is given by:

$$H_t = \int_{\lambda_0}^{\lambda_0} H_{s\lambda}\cos\theta_0\, d\lambda + \int_{\lambda_0}^{\lambda_0} S_\lambda\, d\lambda_\zeta \quad (23)$$

Here $H_{s\lambda}$ is the ground spectral irradiance; θ_0 is the nadir angle of the incident solar rays; S_λ is the scattered or sky spectral irradiance. To simplify calculation, $NE\Delta\rho$ can be expressed as follows:

$$NE\Delta\rho = \frac{\pi NER}{0.707 H_\lambda \Delta\lambda} = \frac{\pi NER}{0.707 H_p} \quad (24)$$

where H_p is the target irradiance; H_λ is the target spectral irradiance; and Δ_λ is the spectral bandwidth. In the calculation, the nadir angle is assumed to be 45°, and the H_λ is the sea-level solar irradiance taken from the P. Moon Table. The assumed conditions are: atmospheric mass m - 2;

91

atmospheric pressure - 101.3 kPa; and water vapor pressure - 2.7 kPa. Sky irradiance or scattered irradiance is not considered.

The effects of atmosphere and weather conditions on radiant calculations are very complicated; specifically, the exact conditions must be specified and sophisticated models must be used in the calculation. For preliminary system calculations, however, the atmosphere effects can be represented by the transmissivity τ_a in the atmospheric spectral band.

The signal-to-noise ratio can still be represented by equation (18), but the term $N(\Delta\lambda)_{To}$ should be replaced by the reflected radiance

$$N = \frac{\rho E}{\pi},$$

(26)

where ρ is the average spectral reflectance; E is the target irradiance in the band, i.e., H_{λ} of equation (24). Thus, from equation (18), we obtain

$$S/N = \frac{\rho H_{\lambda} \Delta\lambda}{\pi NER} = \frac{\rho}{0.707 \, NE\Delta\rho}$$

(27)

If the reflectance in the band 1.55 - 1.75 μm is 1 - 95 percent, then the corresponding signal to noise ratio $S/N = 0.22 - 21$.

V. Conclusion

Radiant sensitivity is one of the most important characteristics parameters of radiometers. The basic procedure of designing this type of instrument involves determining the radiant sensitivity and associating this parameter with other characteristic parameters such as spatial and spectral discrimination capability, while at the same time taking into consideration the structural parameters of the instrument (e.g., characteristic parameters of the optical system and the detector) and the performance of the space vehicle (V/H). To facilitate the design process, an equation for the noise equivalent radiance has been established in this article, equation (14). Although this equation was derived for the case of a multispectral scanner, the same principle and method may be applied to other instruments of similar type.

3012/9365

92

Infrared Measurement for Re-Entry Body

[Article by Zhao Congzhong [6392 1783 1813]]

[Text] I. Introduction

When a re-entry body enters the earth's atmosphere at high velocity, it is subject to the violent phenomenon of photoelectric recombination. It is surrounded by a high-temperature plasma shield which interferes or cuts off radio telemetry signals, and emits a large amount of ultraviolet, visible, and infrared radiation. By measuring and exploiting the series of optical signals produced during re-entry, it is possible to use the information for precision guidance and to predict the point of retrieval of the flight vehicle.[1,2]

In this paper, the measured results of a full-scale re-entry body using a PbS radiometer are presented. These results provide valuable reference data which are of practical interest.

II. Basic Principle

When a re-entry body traveling at hypersonic speed enters the atmosphere, very high temperatures are produced by the effects of aerodynamic heating; specifically, the wall temperature can reach 3,000-4,000 K (the stagnation temperature approaches 8,000 K), and the wake flow behind the body extends approximately 880 m long; at the same time, high-energy radiation is also generated in the ultraviolet, visible, and infrared bands.

The radiated power can be expressed in terms of the rate of change of kinetic energy of the re-entry body.[3]

$$\frac{d(KE)}{dt} = \frac{1}{2}V^2\frac{dm}{dt} + mV\frac{dV}{dt};$$

(1)

where V and $\frac{dV}{dt}$ are, respectively, the velocity and acceleration of the re-entry body; m is the mass; and $\frac{dm}{dt}$ is the rate of ablation of the protective material. V and $\frac{dV}{dt}$ can be measured by radar and by ballistic camera; m is

a known quantity; and $\frac{dm}{dt}$ can be determined from ablation tests conducted in a plasma wind tunnel for a selected material. Thus, $\frac{d(KE)}{dt}$ can be readily obtained from equation (1). Equation (1) can be used to estimate the optical radiation efficiency of the re-entry body.

The radiated power of the re-entry body can also be obtained from the following formula, whose validity can be verified by optical tests.

$$W_\lambda = \frac{4\pi R^2 H_\lambda}{T_{a\lambda}};$$ (2)

where

$$H_\lambda = V_s/V_g \cdot NEFD_\lambda$$ (3)

and

$$J = \frac{R^2 H_\lambda}{T_{a\lambda}};$$ (4)

In the above formula, R is the slant range between the re-entry body and the radiometer (km); H_λ is the irradiance on the receiving aperture of the radiometer (W/cm^2); $T_{a\lambda}$ is the atmospheric transmissivity between the re-entry body and the radiometer; V_s' is the measured signal voltage of the re-entry body (mV); V_g is the measured background voltage (μV); NEFD is the system sensitivity of the radiometer (W/cm^2); and J is the radiant intensity of the re-entry body (W/sr).

III. Test Equipment and Calibration

The test equipment primarily consists of the optical head section and the electronic data processing unit. The optical head section contains the primary mirror (1), the secondary mirror (2), the motor (3), the reticle (4), the light cone (5), and PbS elements (6). The electronic data processing unit contains the preamplifier, the 2107 spectral analyzer, the 2305 recorder, and the time division unit, as shown in Figure 1.
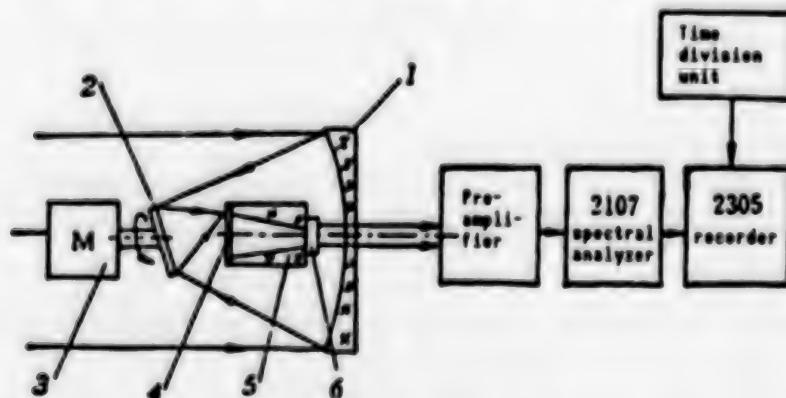

Figure 1. Schematic Diagram of Radiometer

1. The Optical Head Section

It uses the Newton system: the primary mirror has a parabolic shape with an aperture diameter D=250mm; the secondary mirror is a plane mirror with diameter d=110mm and focal length f=680mm; the total system field of view is 2ω - $3°7'$. The PbS elements are 6x6mm in size, and operate in the frequency band of 1 - 3 μm at normal temperatures, D*=0.5-2x10^9 cmHz$^{1/2}$/W, the windows are made of germanium. The light cone has an entrance aperture of ϕ - 20mm and an exit aperture of ϕ - 5mm; it has narrow slits with 1mm separation which are aligned parallel to the re-entry direction. The reticle has a linear region of 20 - 24'. The axis of rotation of the motor-driven secondary mirror is offset from the vertical to the optical axis to ensure that the incident light rays follow a conical scan. The scan circle falls on the focal plane (i.e., on the reticle); the size of the scan circle is ϕ - 10mm. The signal frequency is determined by the product of the number of turns of the motor and the number of slits on the reticle. The low-frequency background clouds are frequency-filtered in order to extract useful information of high-frequency targets. The dispersion circle of the optical system is 0.3mm in diameter.

2. The Electronic System

The PbS elements are connected by lead wires to the preamplifier, which has an amplification factor of 10. Because of the rich frequency content of the striped reticle, a 2107 spectral analyzer is used for frequency selection, and a 2305 recorder is used to record the data on paper tape. The actual frequency selected is 500 Hz. The time division unit provides timing marks once per second which are recorded on paper tape; the paper speed is chosen to be 1 cm/second. The technical specifications of the preamplifier circuit are: f=1 kHz; amplification factor=10; maximum input=220 mV; input impedance=2.8 MΩ; noise level=10 μV with circuit open and 5.6 μV with the elements connected (510 kΩ); bandwidth=30 - 80 kHz; signal input voltage has linear region of 2 - 200 mV, hence the linear region of the signal output is 20 - 2000 mV.

3. Instrument Calibration

(1) Calibration equipment

The calibration system is shown in Figure 2. It can perform field calibration during nighttime.
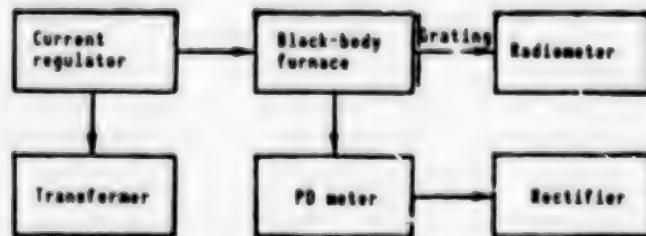

Figure 2. The Calibration System

It should be pointed out that calibration of the radiometer should be carried out using a collimated infrared source, as suggested in Reference [4]. Here, the radiometer is calibrated data distance 166 m from the black-body furnace, so that the subtended angle of the black-body is sufficiently small to ensure collimation; the resulting relative error is no greater than 1 percent. The radiometer is calibrated before and after the test to guard against changes in sensitivity due to unknown causes.

(2) Calibration results

The formula for estimating the system sensitivity of the radiometer is as follows:

$$\text{NEFD} = \frac{\epsilon \sigma T^4 \Delta S \tau}{L_0^2 \pi V_s / V_N}$$

(5)

where ϵ is the transmission coefficient; σ is the Stefan-Boltzman constant; T is the black-body furnace temperature (K); ΔS is the radiating area of the black-body furnace; τ is the atmospheric transmissivity between the black-body furnace and the radiometer; L_0 is the distance between the black-body furnace and the radiometer,[4] when the infrared emission from a black-body furnace located at the focal point (focal length equal to f_0) of the single-reflection collimator is used as the calibration source, then $L_0=f_0$; V_s is the black-body signal voltage measured by the radiometer; and V_N is the background noise. By substituting the measured parameter values (T=838.8K, radiant aperture of the black-body furnace ϕ = 1.5cm, L_0=166 m, V_s=15.5 mV, V_N=165 μV, τ=0.4) into equation (5), one obtains NEFD = 4.48×10^{-12} W/cm^2.

IV. Test Results

1. Primary Test Results

The total observation time of the re-entry phenomenon was approximately 25 seconds. The measured data after processing and simplification are presented in Table 1.

Table 1.   Radiant Measured Data for the Re-Entry Body

Re-entry parameter			Radiant measured data			
$t(s)$	$h(km)$	$R(km)$	$V_s(mV)$	V_s/V_N	$H(W/cm^2)$	$J(W/Sr)$
0	54.3	97.2	48	193	8.6×10^{-10}	4.1×10^5
3	46.5	85.4	593	2371	10.6×10^{-6}	3.7×10^6
6	38.6	72.6	1000	4000	1.8×10^{-6}	4.7×10^6
9	30.7	58.9	1117	4468	3.0×10^{-6}	3.4×10^6
12	22.0	46.1	548	2192	9.8×10^{-7}	1.1×10^6
15	15.3	34	531	2125	9.5×10^{-7}	5.6×10^5
18	8.7	24.5	803	3214	1.4×10^{-6}	4.3×10^5
21	3.2	17.6	71	288	9.8×10^{-10}	3.0×10^4

The parameters t, h, R are time, re-entry height and slant range, respectively. V_g is the sky background noise, whose measured value is V_g-250 μV. The weather condition was good during the test, which resulted in consistent background measurements.

2. Re-entry Radiant voltage and Intensity Curves

(1) Figure 3 shows the radiant voltage of the re-entry body as a function of time, V_s-f(t).
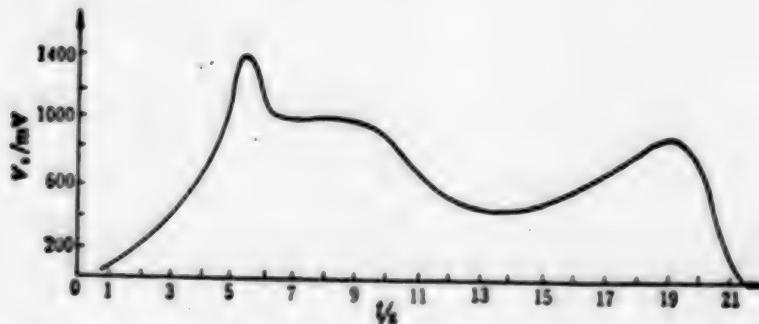

Figure 3. Signal Voltage Versus Time for the Re-Entry Body

It can be seen that the signal fluctuations depend on such factors as the target roll motion, variations in the sun angle relative to the target and the earth reflection characteristics, the instrument alignment accuracy, the target mass to drag ratio, and the atmospheric transmission and scattering properties. The curve indicates that the re-entry radiant signal exhibits a general trend of an initial rise followed by a drop; the maximum value is reached at an altitude of approximately 40 km, at which point the instrument becomes saturated; the dynamic range can be as high as 10^3. The maximum radiant power is W_λ = 5×10^7 W.

(2) Figure 4 shows the variation of radiant intensity with altitude, J-f(h). At an altitude of 40 km, the radiant intensity reaches a maximum value of J-4×10^8 W/Sr.
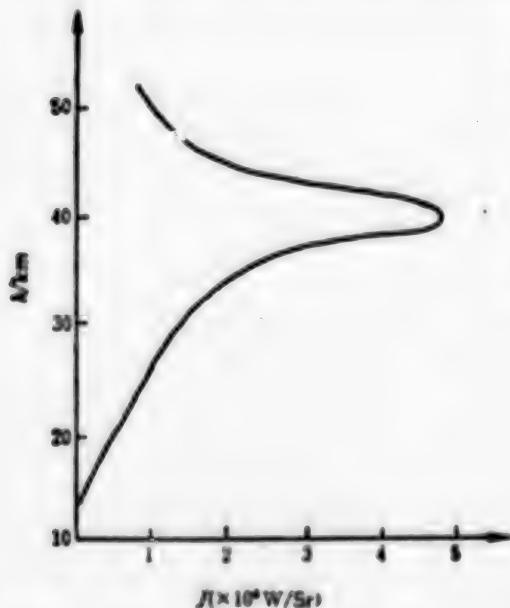
Figure 4. Radiant Intensity Versus Altitude for the Re-Entry Body

3. Analysis

(1) When the re-entry velocity reaches 4.5 km/sec (corresponding to an altitude of approximately 40 km), it begins to decelerate due to the effects of intense aerodynamic heating and aerodynamic drag; when it slows down to 2.4 km/sec, the re-entry body falls back to earth.

(2) The abrupt change in velocity and the corresponding rise in optical radiation occur at an altitude of approximately 40 km, which is consistent with the sudden increase in measured radar returns. There is also clear evidence of change in the wake.

(3) The measured radiant power of the re-entry body is approximately $10^4 \sim 10^8$ W. The radiant intensity if $J=10^3 \sim 10^7$ W/Sr. It is estimated that a 900-kg object traveling at a velocity of 6 km/sec and an acceleration of 50 g's can generate a total radiant power of 3×10^9 W, which can serve as a reference data point for this test. This proves that a hypersonic re-entry body is an intense source of visible and infrared radiation. At night, its brightness is comparable to a third-class star, which is 1,000 times brighter than a planet.

(4) The data presented in this paper show that it is feasible to use a PbS radiometer to measure the optical radiant signals from a 4.5 km/sec re-entry body at a slant range of 100 km under good weather conditions.

V. Conclusion

1. This test has demonstrated the success of using a PbS radiometer to measure the optical radiant characteristics of a hypersonic re-entry body. The model derived from the measured data realistically reflects the characteristics of the re-entry body.

2. The maximum measured signal-to-noise ratio during the test is $V_s/V_N=4466$; the corresponding altitude is 31 km. At a maximum slant range of 97.2 km, the signal-to-noise ratio is $V_s/V_N=192$; hence the radiometer has the potential of extending its present operating range.

3. Because of the complicated test environment, further efforts should be made to improve the test equipment, and the measurement techniques and accuracy.

4. Acknowledgement--Thanks are due to Comrade Xu Gengxin who is responsible for system engineering for the re-entry test, and to Comrade Yao Lianxin for providing valuable suggestions.

3012/9365

Electric Parameter Performances of a C-C Transfer Discharge Pumped XeCl Laser

[Article by Deng Guoyang* [6772 0948 2254], Yuan Dachang [5913 6671 7022], Wang Shaoying* [3769 4801 5391], Xie Fangqing [6200 0119 0615], Ma Jun [7456 6511], Fei Ruian [6316 3843 1344] and Gu Zhiyu* [7357 0037 3768] of Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences: "Electrical Parameters of XeCl Excimer Laser Pumped by C-C Transfer Discharge"]

[Text] 1. Introduction

A practical excimer laser is usually pumped by UV pre-ionization or C-C transfer discharge. Variation of electrical parameters has a significant impact on the performance of an excimer laser excited by electrical discharge. However, there are no in-depth, systematic studies on the electrical parameters in the current literature. On the basis of simultaneous monitoring of the discharge current, voltage wave form, and laser energy output, the results of a study of the effect of electrical parameters such as charging voltage, circuit inductance and capacitance on a C-C transfer discharge pumped XeCl laser are reported to provide a reference for the design of a practical laser of this type.

2. Brief Description of Experimental Apparatus

The experimental set-up has been reported in another paper[1]. For ease of discussion, Figure 1 shows the principle of electrical excitation of the laser and its equivalent circuit. C_s and C_d are the energy storage capacitor and transfer discharge capacitor, respectively. L is the charging inductance. The UV pre-ionization spark lights up the discharge area through the cathode grid. A potentiometer is used to measure the voltage across C_d at A and B. The grounded end E of the anode is put in

---

series with a shunt to monitor the discharge current across the laser gas. In the equivalent circuit, L_1 and L_2 represent the equivalent inductance in circuit 1 (charging circuit from C_s to C_d) and circuit (discharging circuit from C_d through laser gas), respectively; R_1 and R_2 are the equivalent resistance of circuit 1 and circuit 2 (primarily the laser gas), respectively. The latter is a function of time. The working principle of the laser and the solution of the circuit equation are also in reference 1. The electrical parameters corresponding to the maximum laser output ($\lambda = 308$ nm, $E = 328.5$ mJ) are $L_1 + 79.1$ nH, $L_2 + 10.3$ nH, $C_s + 200$ nF and $C_d + 54$ nF.
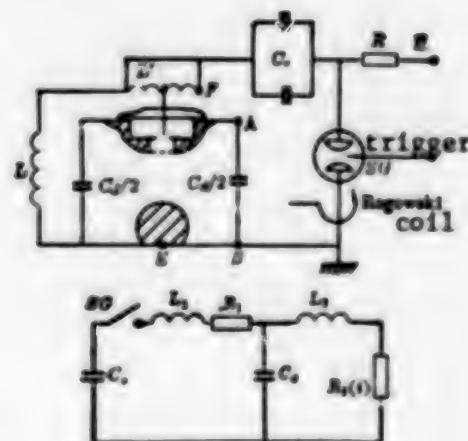

Figure 1. Principle of Electrical Excitation of Laser and Its Equivalent Circuit Diagram
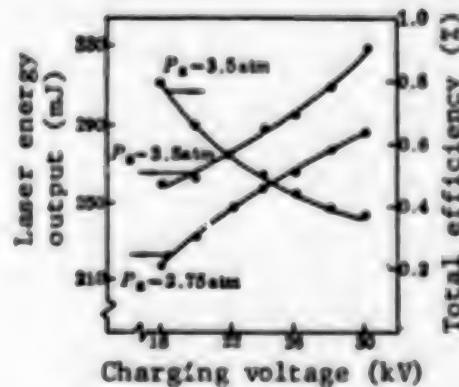
Figure 2. Dependence of Laser Energy and Total Efficiency upon Charging Voltage Cl:Xe = 4.8 Torr:50 Torr

100

3. Variation of Charging Voltage

At a fixed ratio of HCl:Xe = 4.8 Torr:50 Torr, Ne was added as a buffer. The charging voltage V_o was varied at a total pressure of 3.5 atm and at 2.75 atm. From Figure 2, the energy output increased as V_o was raised. When P_{total} = 3.5 atm, the increase in output is faster than linear, indicating that raising V_o would favor higher output at high pressures.

We recorded the voltage wave form at every discharge. Figure 3 shows the variation of the voltage rise time t_r (defined as the time to reach peak voltage from the start) and that of the peak breakdown voltage U_b with V_o. It was found that the former becomes shorter and the latter rises as V_o increases. Figure 4 shows the wave forms of the discharge voltage at two different V_o. From Figures 3 and 4 it is obvious that raising the charging voltage (thus raising the initial energy stored) can correspondingly increase the energy transferred to C_d. Although the energy output is increased, the gas breakdown angle is also moved forward[1] which lowers the efficiency of the transfer of the initial energy stored to C_d. Therefore, the total efficiency drops with increasing charging voltage, as shown in Figure 2. This suggests that in order to make the device work efficiently at high V_o we should attempt to increase the gas breakdown phase angle by appropriately changing the gas composition and increasing the total pressure.
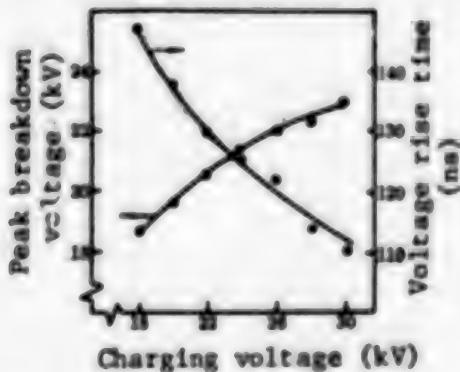

Figure 3. Dependence of Peak Breakdown Voltage and Voltage Rise Time upon Charging Voltage HCl:Xe = 4.8 Torr:50 Torr, Ne filled to P_{total} = 3.5 atm
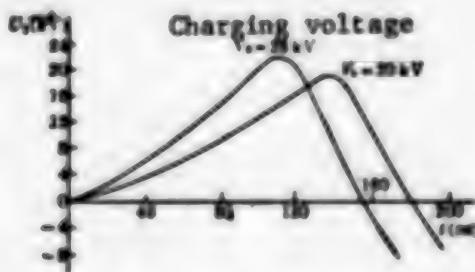

Figure 4. Effect of Charging Voltage on the Wave Form of U_2
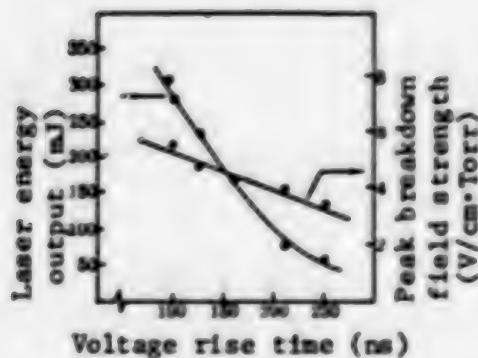
Figure 5. Laser Energy and Peak Breakdown Field Strength at Different
Voltage Rise Times (due to different inductance L_1) total voltage V_o =
24 kV, HCl:Xe:Ne = 0.25%:2.1%:97.65%, P_{total} = 2.5 atm

4. Effect of Inductance

In order to evaluate the effect of L_1 to the laser output characteristics,
we varied the circuit by adding an induction coil between the energy
storage capacitor C_o and the spherical gap SG shown in Figure 1. By
changing the number of turns in the coil, L_1 was increased in steps while
keeping other parameters constant. From the discharge voltage wave form,
the rise time is getting longer monotonically as L_1 increases. Figure 5
shows the energy output and peak breakdown field corresponding to different
rise time t_r (different L_1). It is seen that the energy output is very
sensitive to changes in inductance (L_1 was varied from 79.1 - 230 nH in
the experiment). The energy output drops significantly as L_1 increases.
When the inductance reached a certain value (corresponding to t_r = 300 ns),
the discharge became unstable and the laser approached its threshold.
It was pointed out earlier that the efficiency drops if the output is
increased by raising the charging voltage. However, the high energy output
achieved by lowering L_1 is highly efficient. Thus, reducing L_1 is an
important way to obtain high efficiency, high energy laser output.
Although the experiment was performed in the direction of increasing L_1,
however, it is not difficult to discover the potential of the device in
the direction of further reduction of the inductance by extrapolating the
curve obtained. Based on the experimental data, it is estimated that the
output of the present device (L_1 = 79.1 nH, E = 328.5 mJ) can be increased
by over 10 percent if L_1 is decreased by 10 percent.

Figure 6 shows a comparison of the voltage and injection power wave forms
when L_1 is 79.1 nH to the wave forms obtained when L_1 is 95.4 nH.
Obviously, the leading edge of the discharge voltage wave form is slowed
down and the peak is reduced. Correspondingly, the injection pulse is
delayed and the amplitude lowered. The energy injected is decreased
from 10 J to 6.7 J.
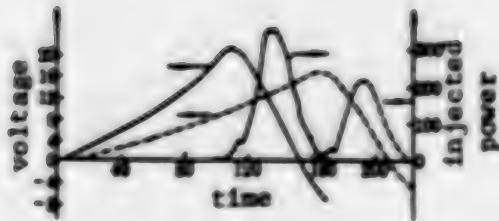
Figure 6. Effect of Inductance on Voltage and Power Injection Wave Form
total voltage V_o = 24 kV, HCl:Xe:Ne = 0.25%:2.1%:97.65%, P_{total} = 2.5 atm

5. Effect of Capacitors C_s and C_d

Based on the solution to the equivalent circuit equation provided in
reference 1 we have derived the expressions to describe the energy and
voltage transfer from the energy storage capacitor C_s to the discharge
capacitor C_d. The energy transfer efficiency is

$$\eta_e = \frac{E_{transfer}}{\frac{1}{2}C_sV_o^2}$$

$$= \frac{C_d/C_s}{(1+C_d/C_s)^2}(1+e^{-\gamma\pi/\omega})^2 \quad (1)$$

and the voltage transfer ratio is

$$\eta_v = \frac{U_b}{V_o} = \frac{1}{1+C_d/C_s}(1+e^{-\gamma\pi/\omega}) \quad (2)$$

where V_o is the charging voltage across C_s, $E_{transfer}$ is the energy
transferred to C_d, U_b is the breakdown voltage of the gas, γ_1 is the
damping factor of the circuit 1, and ω is the angular frequency of
oscillation. These equations were derived under the assumption that
laser gas breakdown occurs when C_d is charged to the maximum voltage.
Equation (1) shows that η_E reaches its maximum at $\eta_c = C_d/C_s = 1$. Obviously,
the most favorable condition for energy transfer is $C_d = C_s$.

The energy stored at C_s is 100 percent transferred to C_d without loss.
However, equation (2) shows that it is more favorable for voltage transfer
if η_c is small. Without considering loss, $\eta_u \to 2$ when $\eta_c \to 0$. The boost
effect of the C-C transfer circuit is realized. It is obvious that the
price for raising the step-up voltage is a reduction in energy transfer
efficiency.

As a matter of fact, the two extreme cases of η_c discussed above represent
the two operating modes of the C-C transfer device. (1) $\eta_c \to 0$, i.e. the
long pulse operating mode. Only a very small portion of the energy

103

stored in C_s is transferred to C_d before breakdown. The boost effect of C_d, however, would help the rapid breakdown of the gas. Subsequently, C_s discharges directly through the gas to provide energy. Because the time constant of the circuit $T_1 \simeq 2\pi\sqrt{L_1 C_s}$ is often very long, the amount of time required to store and extract the energy is also very long. This is a technique to obtain a long pulse excimer laser, as described in references 2,3. (2) $\eta_c \to 1$, i.e. the short pulse operating mode. Prior to breakdown, almost all the energy is transferred from C_s to C_d. After breakdown occurs, C_d discharges directly through the gas and becomes the principal energy supply. Because the discharge period $T_2 \simeq 2\pi\sqrt{L_2 C_d}$ is much shorter than T_1, energy storage and access can be done very quickly. Hence, a highly efficient, high power operation is possible, as shown in reference 4.
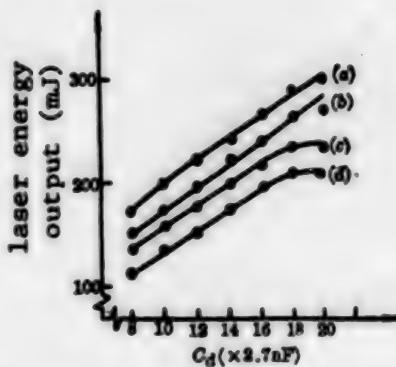

Figure 7.   Variation of Laser Energy Output with C_1 and C_2
(a), (b): $C_s = 200$ nF; (c), (d): $C_s = 100$ nF;
(a), (b): $V_o = 24$ kV; (c), (d): $V_o = 20$ kV;
HCl:Xe:Ne = 0.25%:2.1%:97.65%, $P_{total} = 2.5$ atm

Under the condition that HCl:Xe:Ne = 0.25:2.1:97.65 percent and $P_{total} = 2.5$ atm, the energy output was measured as a function of C_d with $C_s = 200$ and 100 nF. The results are shown in Figure 7. When C_d was varied from 21.6 nF to 54 nF, the output went up as C_d increased, as expected. Based on theoretical analysis, the ideal transfer efficiency ($\eta_E = 1$) happens at $\eta_c = 1$. In the experiment, η_c varied between 0.1 – 0.54. From Figures 7(c) and (d), the output is saturated when $C_s = 100$ nF and $C_d = 54$ nF ($\eta_c = 0.54$). We believe that the boost effect of the circuit is evident. If we raise the charging voltage, saturation will occur at a higher η_c. Comparing Figure 7(a) to (c) we found that when C_d remained constant the output was only lowered by 23 percent when C_s was cut in half (energy stored also cut in half). This demonstrates that the efficiency of the laser is higher when operating at a higher η_c.

Figure 8 shows the voltage current curves at three different η_c. The voltage wave form is uniquely determined by η_c. When η_c increases, the voltage rise gets faster, the breakdown point is moved forward and the breakdown voltage is raised. The current wave form is a complicated
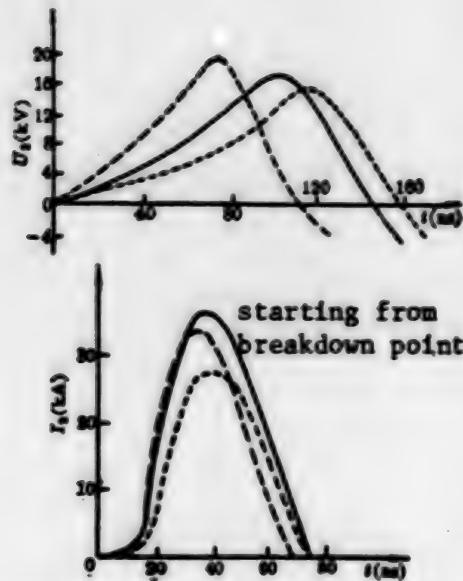
Figure 8. Voltage and Current Wave Forms with Various C_1 and C_2
solid line: C_s:200 nF, C_d:54 nF (η_c:0.27); broken line: C_s:200 nF,
C_d:21.6 nF (η_c:0.11); dotted line: C_s:100 nF, C_d:54 nF (η_c:0.54).
total voltage V_o = 24 kV, HCl:Xe:Ne = 0.25%:2.1%:97.65%, P_{total} = 2.5 atm

function of C_s and C_d. When C_s remains constant, the pulse is wider and
the peak is higher if C_d is higher. When C_d remains constant, the pulse
width is equal. The pulse height goes up with C_s. This indicates that
the pulse width is solely determined by C_d and the peak is dependent upon
C_s and C_d, which also agrees with the theory.[1] As for the discharging
circuit, an approximate expression for the discharge current can be
obtained by analyzing the equivalent circuit (assuming the laser plasma
resistance is a constant R_2).

$$i_2 \approx \frac{2U_b}{\sqrt{\frac{4L_2}{C_d} - R_2^2}} e^{-\frac{R_2}{2L_2}t}$$

$$\times \sin\sqrt{\frac{1}{L_2 C_d} - \frac{R_2^2}{4L_2^2}}t \qquad (8)$$

The breakdown voltage can be expressed in approximation as:

$$U_b \approx \frac{V_o}{1 + \frac{C_d}{C_s}}(1 + e^{-\pi a/\omega}) \qquad (4)$$

Equations (3) and (4) indeed reflect the dependence of current amplitude
and pulse width upon C_s and C_d.

105

6. Conclusions

The results of the study of the electrical parameters of a discharge pumped XeCl laser indicate that these parameters control the energy transfer process to the laser gas which consequently affect the energy output and efficiency of the laser. In order to get a high efficiency high energy laser output, the inductance must be kept low to increase the voltage rise for higher power injection. Raising the charging voltage is only effective when the breakdown phase angle of the gas can be increased. Once the energy storage capacitor C_s is selected, there is an optimal C_d for each device which makes $\eta_c = 1$ in theory. In reality, a different value corresponding to η_c less than 1 should be chosen to consider the voltage transfer ratio.

References

1. Wang Shaoyin et al., Chinese Journal of Optics, 1988; 8(2):125.

2. Mel'chenko S. V. et al., Sov. J. Quant. Electr., 1984; 4(17):1009.

3. Bychkov Yu I. et al., Sov. J. Quant. Electr., 1982; 12(12):1581.

4. Miyozaki Kenzo et al., Rev. Sci. Instrum., 1985; 56(2):201.

12553/9604

World-Class Absolute Gravity Meter Developed

40080182b Beijing RENMIN RIBAO in Chinese 30 Jun 88 p 3

[Article by correspondent Chen Zujia [7115 4371 3946] from Beijing on 29 Jun 88: "World-Class Absolute Gravity Developed"]

[Text] Chinese Academy of Metrology developed a portable absolute gravity meter with an accuracy of 15×10^{-9} cm/sec^2. It is one of a few high-accuracy absolute gravity meters in the world.

In 1985, this portable absolute gravity meter was involved in the Second International Absolute Gravimeter Comparison Activity sponsored by the International Geological Survey Society under the support of the International Metrology Committee. The international standard for this accuracy was set in the meeting. The Chinese absolute gravity meter has the same accuracy as the absolute gravimeters made in the USSR, United States, France, and Italy. This fact attracted the attention from experts in gravity.

The small high accuracy portable absolute gravity meter to be certified today is an improvement of the 1985 instrument. Experts believe that this instrument has several Chinese characteristics. The instrument was designed based on the accordance concept which is one of the three recognized approaches to measure absolute gravity. It uses a data processing technique to eliminate vibration and advanced iodine absorption high stability laser technology. Wang Daheng [3769 1129 3801], a member of the International Metrology Committee and Chinese Academy of Sciences, commented to the reporters that this is a major achievement in metrology in the past 18 years.

Because of the gravitational force of the earth, a falling object is accelerated. When Galileo overturned Aristotle's theory in 1589 and presented the idea that all falling bodies have the same acceleration regardless of their weights, he could not imagine the scientific significance and economic benefit in measuring gravitational acceleration. A high-accuracy absolute gravity meter is valuable to space technology, earthquake prediction and mine prospecting. Wang Daheng

said that a new physical theory is often verified by raising the accuracy of measurement. With the support of the experts at the Chinese National Seismology Bureau, researchers from the Chinese Academy of Metrology used this gravity meter at 23 sites in China, including Urumqi, Harbin, Hangzhou and Kunming to provide accurate data for production, metrology, earthquake research, and survey work.

This study was a key project supported by the Chinese National Foundation of Natural Sciences.

12553/9604

Pyramid-Model-Driven Computer Vision Recognition System

[Article by Luo Yuhua [5012 1342 5478], Jinan University, Guangzhou]

[Abstract] A model-driven computer vision system for recognition of two-dimensional objects is described. Both model and input image are represented in a four-level pyramidal multi-resolution structure. The model is a graph including a set of feature nodes which, via a generalized Hough transform, form a generalized semantic net with a pyramidal structure. The spatial resolving power of each level of the pyramid increases as one goes down--from a 16x16-pixel array at the top through 32x32 and 64x64 arrays to a 128x128 array at the bottom level. The input image is converted into a pyramidal structure as well. The recognition process is driven by the model graph in a top-down order. The top-level match generates a set of hypothesis locations of the model for the lower-level match to verify. The one with the highest score exceeding some threshold is taken to be the final result. The system has been simulated on a VAX-11/780 under UNIX using C language. Eight figures show various pyramidal structures and some computer representations displayed next to photos of the original objects. Three tables list node data and some experimental results. References: 11 in English.

Knowledge-Based Image System

[Article by Wu Jiankang [0702 0256 1660], Department of Radio Electronics, China University of Science & Technology, Hefei]

[Abstract] The concepts and basic techniques of knowledge-based pictorial systems--a combination of high-level image processing and knowledge engineering--are described with a prototype system KBIS being studied at CUS&T. KBIS is a knowledge-based pictorial information system consisting of four subsystems: a pictorial database (or knowledge base) system, a remote-sensing image interpretation expert system, a computer-aided design and planning system, and a computer-aided cartography system. The pictorial database system uses an extended relational model with an abstract data type of frame, which represents and organizes spatial knowledge and other relevant data on objects. The query language has features of visual roaming querying and query guided by knowledge. The remote-sensing image interpretation expert system represents geographical knowledge--forest ecology, water systems, transport, distribution of residential areas, mountain slopes, elevations, etc.--by frames. The reasoning process consists of data-driven forward reasoning involving Bayes classification of multispectral-data Landsat imagery, backward reasoning using frame knowledge, and reasoning using a spatial consistency model incorporating parallel processing techniques. Figures: 3, References: 11 (8 in English, 3 in Chinese).

Large Spectrum Analysis Device Passes Certification

40080182a Beijing GUANGMING RIBAO in Chinese 4 Jul 88 p 2

[Article by correspondent Xu Huaxi [1776 5478 6007]: "Reliability Study Method for Large Spectrum Analyzer"]

[Text] "Reliability Study of Atomic Absorption Spectrophotometer," a key project in the Seventh Five-Year Plan in the Ministry of Electrical Machine Building, was successfully certified on 15 June at the Second Optical Instrument Plant in Beijing. This project was a joint effort involving the plant and Harbin Polytechnical University and the product quality control center of China Optical Instrument Plant. It signifies that China has its own method to study the reliability of large spectrum analysis devices.

Large spectrum analysis devices, which represent a combination optics, mechanical engineering and electronics, are widely used in metallurgy, geology, petroleum industry, chemical engineering, agriculture and forestry, health, food and environmental protection. Atomic absorption spectrophotometer is the most widely used and most representative device. The purpose of this reliability study is to obtain some data to develop a method to increase its mean time between failures and to lengthen its useful life. This type of study was never attempted before in China. There is little information in the foreign literature as well. The project team selected the WFX-IF atomic absorption spectrophotometer, which is made by Beijing Second Optical Instrument Plant and has won bids internationally, as the target of its study. They spent a year and a half to study 45 instruments. They recorded 2496 data points and wrote 17 papers. A method to study the reliability of spectrum analysis devices has been developed based on these documents. Some papers filled the voids in China. The researchers used a testing, improving, re-testing and re-improving approach to increase the mean time between failures from 416 hours to 1252 hours. All performance specifications also meet high standards. The Ministry recently listed this product as a substitute of imports. This item alone will save $1.76 million per year for China.

12553/9604

Study of Near-IR Transparent, High Conductive Si-Ag-Si Coatings Prepared by DC Magnetron Sputtering Using Two S-Guns

[English abstract of article by Ye Zhizheng [0673 1807 6966], et al., of the Department of Optical Engineering, Zhejiang University, Hangzhou]

[Text] Near-IR transparent, high conductive Si-Ag-Si coatings are deposited by DC magnetron sputtering using two S-guns. The parameters of the multilayer are designed and optimized. The Si-Ag-Si coatings with arbitrary thicknesses are sputter-deposited by means of a simple control method. The optical, electrical and mechanical properties of samples are given.

9717

Study of Deep Levels in Narrow Gap Semiconductor $Hg_{1-x}Cd_xTe$ by ATSC Method

[English abstract of article by Lin He [2651 0735], et al., of Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] The deep levels in the narrow gap semiconductor $Hg_{1-x}Cd_xTe$ (x = 0.195 - 0.275) are investigated using the alternating thermal stimulated current (ATSC) method. The physical properties of the deep levels in $Hg_{1-x}Cd_xTe$ are discussed. The experimental results show that the ATSC method is an effective way to investigate the deep levels in the narrow gap semiconductor $Hg_{1-x}Cd_xTe$.

9717

Light-Induced Effects of PL, PC in a-Si_xC_{1-x}:H at Low Temperatures

[English abstract of article by Wang Fuchao [3769 1381 2600] of Zhejiang Agriculture University, Hangzhou; Tang Wenguo [0781 2429 0948], et al., of the Laboratory for Infrared Physics, Shanghai Institute of Technical Physics, Chinese Academy of Sciences]

[Text] The results on the light-induced effects of photoluminescence (PL) and photoconductivity (PC) of a-Si_xC_{1-x}:H under the same exposure conditions at low temperatures are presented. It is found that both the integrated PL and PC intensities decrease rapidly with exposure time at the early stage, and then tend to be steady after prolonged exposure. However, the peak energy position and the shape of the PL spectra remain unvariable after the exposure. The light-induced effects at low temperatures can be eliminated through annealing at room temperature. The mechanism of the light-induced effects is discussed and the kinetic equations for the light-induced effects of PL and PC are derived, and agree quite well with the experimental data.

9717

Pulsed Chemical Oxygen-Iodine Laser Initiated by Electrical Discharge

[English abstract of article by Zhang Rongyao [1728 2837 5069], et al., of
Dalian Institute of Chemical Physics, Chinese Academy of Sciences]

[Text] This paper demonstrates for the first time the feasibility of an
electrically initiated pulsed oxygen-iodine laser which can be initiated
efficiently by low energy electrons. An $O_2(^1\Delta)$-CH_3I-N_2 mixture has been made
to lase by electrical initiation with an output energy of 130 mJ. The
electrical efficiency is 350 times higher than that obtained with photo-
initiation.

9717

Measurement of Electron Beam Distribution in Raman FELs

[English abstract of article by Lu Zaitong [7120 6528 6639], et al., of
Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The bremstrahlung from thick target anodes was measured to de'ermine
the e-beam movement and distribution in the authors' Raman free-electron
laser. The principle of the method and the measurement results of the electron
distribution in the diode and drift tube of the Raman free-electron laser are
presented. The experimental results are in accordance with the theoretical
prediction.

9717

Para-H$_2$ Stimulated Raman Laser Developed

[English abstract of article by Jin Chunzhi [6855 2504 2784], et al., of
Changchun Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] A para-H$_2$ stimulated Raman laser pumped by a TEA CO$_2$ laser has been
developed. The principal factors affecting the Raman conversion efficiency
are discussed. When the laser ran at about 100 K, the maximum output energy
of the Stokes wave at 16 μm was 536 mJ, corresponding to an energy conversion
of 13 percent and a quantum conversion of over 20 percent.

9717

Green, Yellow Pulses of Copper Vapor Laser Oscillator/Amplifier, Influence on R6G Dye Laser Output

[English abstract of article by Liang Peihui [2733 1014 6540], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] This paper experimentally shows that (1) the intensity evolution of green (510.6 nm) and yellow (578.2 nm) pulses of a copper vapor laser oscillator from lasing to steady operation, and (2) the effect of the switching delay time in an oscillator/amplifier system on the amplitudes and the relative delay between both pulses. It is demonstrated that for a R6G dye laser, the conversion efficiency not only depends on the intensity ratio, but also on the relative delay of the green and yellow pulses.

9717

Method for Enhancement of Transition Radiation Intensity

[English abstract of article by Qu Weixing [1448 5898 2502], et al., of Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences]

[Text] The characteristics of the transition radiation quantum spectrum produced when high energy relativistic electrons pass through a foil stack, the mechanism for producing transition radiation and the principal unfavorable factors affecting the enhancement of the intensity of transition radiation are analyzed, and a new method is put forward, based on the analysis, to increase the intensity of the transition radiation.

9717

Investigation of Physico-Chemical Processes of KTP Crystal Growth From Phosphate Fluxes (I)

[English abstract of article by Liu Xiangyang [0491 0686 7122] of Fujian Institute of Matter Structure, Chinese Academy of Sciences, Fuzhou; Jiang Minhua [5592 3046 5478] of the Institute of Crystal Materials, Shandong University, Jinan]

[Text] Some careful research has been conducted on the dissolution processes of KTP crystals in phosphate fluxes, and on their variations in the solubility and substability regions for crystal growth. Compared with the results of phosphate composition analysis, the varying rules shown in different processes and the dependence of several factors on each other have been studied further. Different phosphate fluxes and their composition effects on the KTP crystal growth habit are also discussed.

9717

Development of Remote Sensing Receives Boost

[Article by Ouyang Wangjing (2962 7122 3769 7231): "China's Remote Sensing Facilities Beginning to Take Shape—Information Processing Power Increased, Areas of Technological Application Broadened"]

[Text] (Special Report)—Since its first appearance in the sixties, remote sensing technology has seen wide applications in China. The nation has realized a number of significant achievements in remote sensing technology—in basic research and in development of instruments and software. According to industry specialists, China's remote sensing image processing technology involves many areas such as optics, optoelectronics, photochemical processing, and computerized digital image processing. In this last area, with the exception of almost 20 imported image processing systems, the progress of Chinese scientists and technicians in raising information processing power has been based on [domestically] available software and on software newly developed by the researchers. For example, the PIPS digital image processing system developed by the State Bureau of Surveying and Cartography's Institute of Surveying and Cartographic Science can be used for a variety of processing operations on aerial and space images as well as to make specialized maps and image charts. The Landsat, SPOT satellite and weather satellite ground receiving stations imported by China from abroad are now all in operation, and can provide extended duration photographic image data.

Remote sensing technology here in China has already been widely applied in areas such as agriculture, forestry, water conservancy, geology, land survey, allocation of energy resources, environmental protection, and urban planning; a number of major achievements have been made in these areas. Examples include the use of satellite photography to determine the distribution of various types of land resources, to conduct geological surveying in outlying districts, and to carry out environmental assessments in certain locales—all of which have produced notable economic and social benefits. Remote sensing technology has become a critical research tool in several major scientific research projects of the Seventh 5-Year Plan, such as a comprehensive survey of the loess plateau and a comprehensive treatment of [the water problems of] the Huang He-Huai He-Hai Zhou plains.

In order to accelerate the application and development of remote sensing technology, China has established a State Remote Sensing Center, charged with formulating a national developmental policy for remote sensing technology and drafting a remote sensing development program. To date, several branches of industry and some provinces and districts have also set up remote sensing organizations or centers to undertake applied remote sensing projects in specialized fields or areas of development. As revealed by the specialists, China is presently concentrating its scientific and technological forces on developmental research in the direction of current international remote sensing technology and is speeding up research on hardware and software functions for remote sensing image processing systems.

/9604

BRIEFS

New Ultralight RPV Developed—The "Fengwang" [Queen Bee]-1 radio remote-controlled unmanned aircraft recently developed by the National Defense University of Science & Technology is a highly mobile and functional robot aircraft. Designed via CAD technology, this device has a total weight of less than 10 kg [sic], and has broad applications in areas such as aerial remote sensing, geological prospecting, forest management, detection of fire, windstorm and flood damage, earthquake monitoring, atmospheric sampling, environmental survey, agricultural crop distribution, and pest infestation survey. [Text] [40080015b Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese 27 Jul 88 p 4] /9604

Doppler Acoustic Radar Developed—A Doppler acoustic radar has been developed by a joint effort of the China Environmental Sciences Research Institute and the Electronic Instrument Laboratory of Beijing University. This remote sensing technology, which first appeared in the seventies, is used for measuring meteorological data and will also provide important contributions in areas such as environmental protection, atmospheric physics, aeronautics and space, resource utilization, and nuclear power development. The HK-11 Doppler acoustic radar incorporates dual-frequency transmission technology and has an improved signal-to-noise ratio. Its main technical indicators have reached advanced international standards of the eighties; quality is comparable to that of France's Remtech acoustic radar and the U.S. company Environment's M2000 acoustic radar. Intense preparations for batch production of the HK-11 are currently underway, and the first domestically made HK-11 Doppler acoustic radars will soon go into use. [Summary] [40080029 Beijing ZHONGGUO HUANJING BAO in Chinese 6 Aug 88 p 3]

Preparation, Physical Properties of B1 Structure MoN$_x$ Thin Films

[English abstract of article by Shi Yinhuan [0670 1714 3562], et al., of the Institute of Physics, Chinese Academy of Sciences]

[Text] The authors have measured the superconducting transition temperature T_c and resistivity $\rho(T)$ (from T_c onset to 300 K) of the reactive sputtered MoN$_x$ thin films. X-ray diffraction, Rutherford back scattering (RBS), Auger and XPS techniques were used to examine these specimens. The results show that T_c and $\rho(T)$ change obviously with the concentration of nitrogen in thin films. For a B1 structure or nitrogen-rich samples, T_c is lower than 4.2 K, and $d\rho/dT$ is negative when the temperature is higher than that of T_c onset. Auger analysis indicates that the existence of oxygen and carbon may also be the reason for the very low T_c and semiconducting behavior in the $\rho(T)$ of this kind of thin film.

9717

Surface Study of Superconducting Nb-Ge Film by Auger Electron Spectroscopy, Electron Spectroscopy for Chemical Analysis

[English abstract of article by Guo Yuanheng [6753 0337 1854] of the Department of Physics, Beijing University; Chen Lanfeng [7115 1526 1496] of the General Research Institute for Non-ferrous Metals, Beijing]

[Text] Auger Electron Spectroscopy (AES) and Electron Spectroscopy for Chemical Analysis (ESCA) have been applied to the analysis of the super-conducting Nb-Ge film deposited onto a sapphire substrate by a low-energy sputtering technique. The results of surface analysis and depth profiles show that impurities, such as C, O, Al, etc., are contained in the Nb-Ge film, with O being a particularly effective impurity which determines T_c. The segregation of Ge at the surface has not been found. The concentration ratio of Nb/Ge in the film decreased from 3.1 to 2.26 from the surface to the substrate interface. XPS depth profiles show that the photoelectron spectrum of Nb, Ge, C and O exhibits apparent chemical shifts and variations of the peak shape, i.e., the properties and chemical states of these elements are complicated and vary along the depth profiles. It is predicted that Nb will probably stabilize the growth of the A15 Nb_3Ge phase during sputtering deposition.

9717

Localized Resistive State in Superconducting Metallic Glass $Zr_{78}Co_{22}$

[English abstract of article by Zhou Xianyi [0719 0341 1942], et al., of the Department of Physics, University of Science and Technology of China, Hefei]

[Text] In this paper, the authors have systematically studied the I-V characteristic of the superconducting metallic glass $Zr_{78}Co_{22}$ without applied magnetic fields. It is observed that the transition from superconducting to normal states is completed in steps as the current increases. The properties of the steps are localized and depend on the current scanning rate. It is shown that the occurrence of resistive steps is due to the inhomogeneity of materials, leading to the appearance of hot-spots. The one-dimensional thermal flow equation may be used to describe the localized resistive state of the superconducting metallic glass $Zr_{78}Co_{22}$, taking into consideration the effects of the interaction between hot-spots, the self-absorbing heat of the sample itself, etc.

9717

Product Code Vector Quantization of Image Signals in the Walsh-Hadamard
Transform Domain

[Article by Ye Lei [0673 7191] et al., Northwest Telecommunications Engineering
Institute, Xi'an [now called Xidian University (Xi'an University of Electronic
Science & Technology)]]

[Abstract] Since first proposed in 1980, applied research into vector quanti-
zation (VQ) for high-efficiency image coding has resulted in noticeable gains.
The compression mechanism of VQ in the transform domain is first analyzed.
Then, integrating Walsh-Hadamard Transform (WHT) techniques with VQ in an
effective manner, a WHT-domain product-code (PC) VQ method is proposed. The
complexity of this technique is low. Simulation results demonstrate that its
performance is superior to that of other non-adaptive image coding methods.
WHT-domain VQ schemes have greater potential for data compression than those
in the discrete cosine transform (DCT) domain. Five figures show the following:
schematic of the WHT-domain PC VQ system, an 8 x 8 segmentation method for the
WHT domain, graph of coding performance of the WHT-PC-VQ method as compared to
a DCT-PC-VQ method wherein signal-to-noise ratio (SNR) in dB is plotted
against code compression ratio in bits/pel for both techniques, simulation
results (photos) of WHT-PC-VQ coding, and a graph of experimental results of
SNR plotted against rate for both the WHT-PC-VQ scheme and an adaptive-DCT-
multilevel-VQ scheme. Technical appendix, 14 references (4 in Japanese,
9 in English, and 1 in Chinese).

Rapid Development in Fiber-Optic Communications

(Reports from September National Conference [See also FBIS-CHI-88-180, 16 Sep 88, p 37])

Scope, Technology, Production Capacity

40080025 Beijing GUOJI SHANGBAO [INTERNATIONAL BUSINESS] in Chinese 13 Sep 88 p 1

[Special Report: "China's Fiber-Optic Communications Technology Developing Rapidly--Disparity in Production Capacity Compared to Foreign Countries Is Gradually Diminishing"]

[Excerpts] The total length of all fiber-optic communications lines throughout China now exceeds 5000 km of optical cable. Fiber-optic communications systems are now installed in over 80 cities and towns in China, with Wuhan, Shanghai, and Tianjin established as the principal bases. In addition, a number of transdepartmental and transregional fiber-optic communications industry groups and engineering companies have been set up. Fiber-optic communications technology has been applied [domestically] in areas such as posts and telecommunications, electronic circuits, transportation, electric power, hospitals, television broadcasting, manufacturing and mining, and is gradually becoming an indispensable industry for China's national economy.

In the area of fiber-optic technology, China has now mastered the technology for [producing] complete sets of DS4 [140 Mbits/sec] fiber-optic communications systems; gratifying achievements have been seen in DS5 [565 Mbits/sec] science and technology projects; and turnkey operations for DS3[34 Mbits/sec]-and-under fiber-optic communications systems have been supplied.

At present, about 2000 km of municipal telephone repeater line and about 1100 km of long-distance line have been laid for posts and telecommunications public networks; railroad authorities have laid several hundred km in their fiber-optic communications systems, power authorities have built over 30 special-use systems, over 40 television broadcasting stations use optical-cable transmission systems, and 20-30 industrial and mineral firms--including Capital Iron & Steel, Anshan Iron & Steel, Wuhan Iron & Steel, the Second Automotive Manufacturing Plant, and the Yangquan Coal Mine--also use optical-cable transmission systems.

By 1990, total annual production capacity for fiber-optic communications can reach 60,000 km. In the next few years from now, new construction will gradually replace coaxial cables with fiber-optic lines, and the gap with foreign countries will gradually be reduced.

Resources, Pilot Project Units

40080025 Beijing ZHONGGUO JIXIE BAO in Chinese 13 Sep 88 p 1

[Special Report: "Song Jian Vigorously Promotes Applied Fiber-Optic
Communications, Establishment of Fiber-Optic Communications Industry, Modernization
of Domestic Communications"]

[Excerpts] Since the early seventies, almost 110 scientific, production,
educational, and design & construction institutions have been established in China
for the study of fiber-optic communications technology. In addition, almost
10,000 personnel (of whom about 50 percent are technicians) have been trained.

Conference members issued commendations to representatives of [China's] 15 pilot
projects in fiber-optic communications engineering design and construction. Units
receiving awards included the Ministry of Machinery & Electronics Industry's (MMEI)
Nanjing Wired Telecommunications Plant, MMEI's Research Institutes 34, 23, and 8,
the Shanghai Municipal Fiber-Optic Communications Engineering Company, the
Shanghai Cable Institute, and the Shanghai Cable Plant.

Vice-Minister Zhang Xiangdong [1728 0686 2639] of MMEI participated in the
Conference.

More on Pilot Projects

40080025 Beijing GUANGMING RIBAO [GUANGMING DAILY] in Chinese 12 Sep 88 p 1

[Additional untitled report to Special Report: "Song Jian Says Trend Is
Inevitable to Gradual Replacement of Coaxial Cable by Fiber-Optic Communications
[Systems]; Vigorously Promotes Fiber-Optic Communications Applications in China"]

[Excerpts] Beijing, 11 Sep--China's 15 pilot projects in fiber-optic
communications engineering are proceeding well and have already achieved
gratifying results. At a press conference held in the capital on 9 September,
Li Xianglin [2621 4382 2651], Director of the State Council's Office for Promoting
Applications of Electronic Information Systems, remarked that from now on, China
will no longer lay coaxial cable and that we need to vigorously develop fiber-
optic communications.

The 15 pilot projects in fiber-optic communications engineering, according to
comrade Li Peng's directive "Development of Fiber-Optic Communications Must Draw
on the Methods and Experience Learned from Satellite Television Experimental
Projects," will concentrate on eight critical applied areas in fiber-optic
communications. As of now, four of these 15 projects are operational, three have
passed ministry-level accreditation, and the others are actively under development.

An example [of an operational system] is the Jingzhou-Shashi overhead optical-
cable project [see JPRS-CST-88-016, 29 Aug 88, p 105], built at a cost half that
of a coaxial cable system and in only 139 days--a feat difficult to accomplish
with other communications lines.

/7310

Briefs

Hunan Fiber-Optic Line Open--Hunan Province's first 140Mb/s, 50-km unrepeatered, 1,920-circuit large capacity fiber-optic communications system construction project has been completed, passed its acceptance check a few days ago, and is now formally operational. The system meets the 97 percent standard connection rate for small volume standby traffic. With a total investment of over 6.32 million yuan, this system will permit Xiangtan to become another city in the province with direct-dial long-distance calling. [Text] [40080018a Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 30, 10 Aug 88 p 1]

Fiber-Optic Digital Multiplexing Equipment--Seven sets of varying-capacity electronic terminal equipment for fiber-optic DS2, 3, and 4 [8Mb/s, 34Mb/s, and 140Mb/s, respectively] digital multiplexed communications, developed by Institute No 5 of the Ministry of Posts & Telecommunications, are being manufactured by the Meishan [4168 1472] Communications Equipment Plant in Sichuan. Of these sets, the DS4 system has a 1,920-voice-circuit capacity, currently the largest for domestic fiber-optic digital communications equipment, and is the first such Chinese-made system to pass ministry-level technical certification (in December 1987). Meishan, the first plant in the nation's network of posts and telecommunications firms to produce DS4 equipment, offers three sets of this equipment meeting CCITT-recommended international standards. Now in small batch production, these products are scheduled to be used in domestic digital fiber-optic communications networks by the end of this year. [Summary] [40080018b Beijing DIANZI SHICHANG [ELECTRONICS MARKET] in Chinese 28 Jul 88 p 2]

First Fiber-Optic Line in Jiangxi--Construction of Jiangxi Province's first optical-cable communications project (Xinyu municipal exchange to the Fenyi Xian [county] exchange) was recently completed. This 30-plus-km-long project uses optical cable imported from Japan's MEC [Mitsubishi Electric Corp]. Completion of this project has laid a foundation for the digital program-controlled telephone network linking Xinyu City and Fenyi Xian. [Text] [40080013a Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 8, Aug 88 p 47]

Solar Power Supply for Fiber-Optic Lines--A seasonally adjustable solar-energy communications power supply was recently developed by the Posts & Telecommunications Research Institute of Fujian Province, and has been installed in two unattended repeater stations in the fiber-optic communications system linking Nanping and Yong'an [both in Fujian]; overall operation has returned to normal. This is China's first use of a solar-energy power supply as an independent power source for a fiber-optic communications circuit. [Text] [40080013b Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 8, Aug 88 p 47]

Birefringent Single-Mode Optical Fiber--Beijing Optical Fiber Research Laboratory recently developed a "highly birefringent single-mode optical fiber." The development of this high-tech product is a major breakthrough for China's fiber-optic technology. Birefringent single-mode optical fiber is a basic material in fiber-optic gyros, fiber-optic sonar, and other phase-type fiber-optic sensors, and is also the transmission dielectric for coherent optical communications technology. It is applicable to areas such as aeronautics, space, and telecommunications. Only a small number of developed nations--such as England, the U.S., and Japan--can currently produce this type of optical fiber. After batch production of this product, China can realize a great savings on foreign exchange. [Text] [40080026a Tianjin JISHU SHICHANG BAO [TECHNOLOGY MARKET NEWS] in Chinese 17 Aug 88 p 1]

Nanchang-Jiujiang DMW System-- A 4GHz all-solid-state 480-line digital microwave system has been installed in Jiangxi province between Nanchang and Jiujiang and trial operation is now underway. The next step is for the circuit to receive [technical] accreditation. [Text] [40080026b Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 9, Sep 88 p 47]

END

END OF
FICHE
DATE FILMED

5 Dec 1988